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The Spawning of the Plaice (*Pleuronectes platessa*) in the North Sea

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The Spawning of the Plaice (*Pleuronectes platessa*) in the North Sea

I. INTRODUCTION

SOON after Hensen had developed methods for the quantitative study of the plankton, he and Apstein embarked on a very extensive programme of plankton surveys—the 'Nordsee Expedition' of 1895—to estimate the total stock of fish in the North Sea by means of the number of eggs they spawned and the fecundity of the females. The project was completed and the total stocks of mature female cod, haddock, plaice, flounder, dab and long rough dab were estimated at 1,206 millions, including 103 million plaice (Hensen and Apstein, 1897).

However, although the concept itself was quite outstanding, the estimations lacked precision, due to a number of factors, such as an uncertainty of the identification of some fish eggs, including the plaice (Johnstone, 1908), and an assumption that the spawning of all species was sufficiently evenly spread over the sea not to need detailed knowledge of the spawning areas.

Buchanan-Wollaston, appreciating the need to delineate the spawning areas, used quantitative plankton surveys, based on those of Hensen, to study in detail the spawning areas of the plaice.

The investigations described here are a direct development of the work of Buchanan-Wollaston in which he set out to determine:—

"(1) The position and extent of the spawning grounds.
(2) Yearly variation in (1) and, of course, their variation within the limit of each spawning period.
(3) The number of eggs produced on each spawning ground, or—what yields the same result—the number of fish spawning on the ground and the average fecundity of the fish.
(4) The course taken by the eggs after extrusion, their stage of development at each stage of their journey, and the same for the larvae, as well as their final destination as small bottom-living fishes". (Buchanan-Wollaston, 1914, p. 1).

The results of his investigations in 1911, 1914 and 1921 are well known (Buchanan-Wollaston, 1914, 1923, 1926), and gave fairly complete answers to (1), information for two years on (2), one estimate of egg production in the Southern Bight (3), and some estimates of the drift of eggs (4) and their mortalities, as well as material for discussions on such topics as the conditions influencing plaice in their choice of a spawning ground.

The data presented here include the results of plaice egg surveys made each year during the periods 1935 to 1939 and 1947 to 1950. The surveys of 1935 to 1939 were planned and carried out by Buchanan-Wollaston and worked up by the present author, while the surveys of 1947 to 1950 were the author's responsibility throughout. The investigations since 1946 have been directed largely towards completing the work that Buchanan-Wollaston started, partly by filling certain important gaps and partly by presenting together a résumé of the published and new data so that a general appraisal can be made of the stability of spawning, as well as its changes over a period of nearly forty years. Fig. 1 sets out the times of all the plaice egg surveys reported upon in this paper.

The most important gap in the data lay in the absence of information on the amount of spawning that took place in areas outside the Southern Bight of the North Sea. This gap has largely been filled by our own observations in the Flamborough area, south of the Dogger Bank and the eastern English Channel and by those of Aurich (1941) and Bohl (1954) in the area between Helgoland and the Dogger Bank. An attempt is made in section VI to assess the relative importance of these areas.

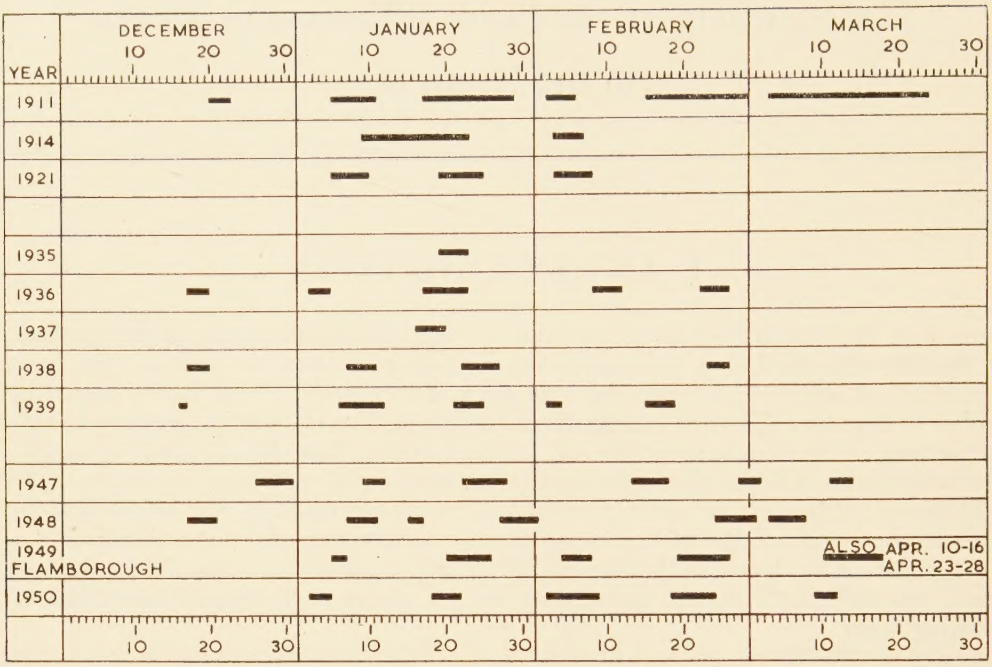


Fig. 1. *The times of the plaice egg surveys which form the basis of this report. Temperature and salinity observations were made at all stations in the years* 1911, 1914, 1921, 1939 and 1947–1950.

Another major gap was in our knowledge of the fecundity of the plaice. This subject was investigated in 1947 and 1948 and has been published as a separate study (Simpson, 1951).

The long period, 1911–1950, covered by these investigations, and the considerable number of surveys involved, now permits a much better appraisal of the variations in time and position of spawning than has yet been possible with any species. The data now available gives information on the range in annual egg production that has occurred between periods of heavy and light exploitation of the stock.

In 1947, shortly after the peak of egg production had been reached in the southern North Sea, there occurred a period of exceptional cooling of the southern and eastern North Sea. Although the associated easterly gales made impossible regular observations of the effect of the cold conditions on the spawning fish and the fate of the eggs and larvae, a good deal of information was obtained of the effect of these exceptional conditions and this has been described elsewhere (Simpson, 1953a).

In order to investigate the fecundity and age and size composition of the spawning plaice, trawling was carried out in the spawning area. Sampling the spawning females by this means proved exceptionally difficult due to the very short time the females spend in the spawning area. However the results, although meagre, do also provide interesting information on the spawning migration as well as the remarkable change in age composition of the spawning stock that took place between 1946 and 1949.

In later years the investigations were increasingly directed towards determining the fate of the eggs and larvae, but it has proved impracticable to use the survey method for larval mortalities. This has been due to the considerable and very variable degree of drift of the larvae that occurs in different years and the consequent greatly increased area that has to be surveyed if the mortalities are to be accurately assessed. New methods are being developed, based on the following and frequent sampling of patches of eggs and larvae.

During the surveys of the plaice spawning areas the eggs and larvae of many other fish (*Gadus merlangus*, *G. luscus*, *G. callarias*, *Pleuronectes limanda*, *P. flesus*, *Ammodytes marinus*, *Clupea harengus* and *C. sprattus*) have been caught and studied, and their distributions in 1946/47 and 1947/48 have been described separately (Simpson, 1949, a and b).

II. METHODS

When the surveys were resumed in December 1946 it was decided to use, as far as practicable, the same gear and methods as used by Buchanan-Wollaston so that the quantitative data should be directly comparable with those from the earlier series.

The methods have, however, been modified in certain details and this section on methods has been included to make the present review more complete (the methods were originally described over 30 years ago), to include the modifications that have been adopted, and to include discussions of the limitations and advantages of these methods.

A. AT SEA

Vertical hauls with the Hensen net, as used by Buchanan-Wollaston, were adopted, and have continued to prove very satisfactory in the relatively shallow depths of the southern North Sea. The dimensions of the net, using bolting silk with 60 meshes to the inch have remained unchanged (Buchanan-Wollaston, 1911). Buchanan-Wollaston (1911, p. 225) calculated that when the Hensen net was raised at a speed of 1 m in 3 seconds the catch must be multiplied by a factor of approximately 3 to convert it to the catch below 1 sq m of sea surface. This factor has also been adopted for these calculations and the catch at each station has therefore been multiplied by three and divided by the number of hauls made at that station. The net was hauled by a counterweight as described by Buchanan-Wollaston

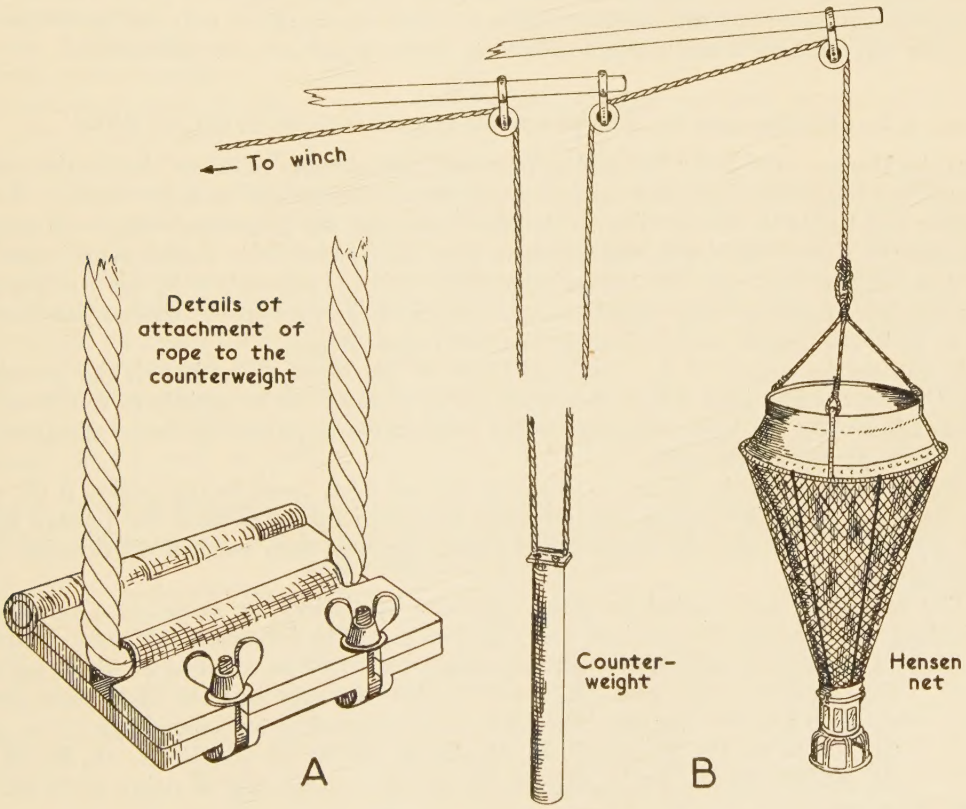


Fig. 2. (A) *Details of the clamp on the counterweight used for adjusting the position of the counterweight on the rope.*
(B) *Arrangement used aboard the research ships for hauling the Hensen net by means of a counterweight.*

(1914), a method which is used as a regular routine for most of the quantitative zooplankton investigations from Lowestoft. As this method does not appear to be widely known or used, and has proved invaluable in these investigations, it is briefly redescribed below.

The aim of the counterweight method of hauling vertical nets is to overcome the irregular speed of hauling, and consequent uneven filtration, caused by the rolling of the ship while lying stopped. The hauling rope was arranged as shown in Fig. 2 and at each station the counterweight was attached to the rope at such a position that when the net was lowered to the bottom of the sea and the weight was raised over the ship's rail, the mouth of the net was 2 fm above the sea bed. The counterweight was then released and the net brought to the surface by the descent of the counterweight. The counterweight was of such a weight (about 125 lb) that the net was raised to the surface at approximately 1 metre per 3 seconds. Owing to the weight of the rope being progressively transferred from one side of the system to the other, the rate of ascent of the net increases during hauling. This is of little importance with hauls of about 30 fm and less, but with hauls of over 30 fm the initial hauling speed is very slow and the final speed excessive. The use of nylon ropes would probably reduce this difficulty and also reduce trouble due to the twisting of the rope just above the counterweight, which can occur, particularly with a new rope. Before 1950 the counterweight was attached to the rope by knotting the rope, but in 1950 a clamping device (Fig. 2) was introduced, through the initiative of Captain T. A. Sutton, which greatly facilitated the alteration of the position of the counterweight on the rope. When the net was clear of the sea it was hosed down from the outside, particular care being taken to direct water round the top of the net where most filtration occurs.

Of the several methods of making quantitative plankton hauls (vertical, oblique, horizontal stepped) the vertical haul has many obvious advantages, particularly when the ensuing calculations aim at giving the absolute number of individuals below unit surface of the sea. However this method is also subject to certain errors which are now discussed.

1. ERRORS DUE TO UNEVEN VERTICAL DISTRIBUTION OF EGGS

Since the Hensen net cannot be used to filter the bottom layer of water, due to the risk of hitting the bottom and filling the net with sand, there is introduced an error which is always negative and has to be allowed for. In shallow water, and the plaice spawning area extends into water of about 9 fm depth, the failure to filter the bottom 2 fm would result in catches being as much as 22% below their true value. This has been allowed for in this investigation by recording the actual water depth and the length of the rope in the water when the net was at its lowest point—and scaling up the catch accordingly.

In the southern half of the Southern Bight of the North Sea, though the bottom is ridged, there are few areas where the depth varies so much or so rapidly as to necessitate further adjustment for depth. However, it has been necessary in the Flamborough spawning area, where depths are irregular.

This correction for the failure to filter the bottom 2 fm could be unjustified if the eggs were spawned off the bottom or through their buoyancy tended to leave the bottom layers very rapidly. To test this, the buoyancy of plaice eggs and their vertical distribution were investigated.

The buoyancy was studied on three occasions by timing the ascent of a number of individual eggs through 10 cm of sea water in glass jars. The following data were obtained:

(a) Eggs from an artificial fertilisation made on 5.1.52 in water of 35·12‰ salinity. Observations made on 9.1.52 at 9·5°C when the eggs had the blastopore almost closed. (Apstein, stage 9). The times in seconds taken to rise through 10 cm were 29, 30, 33, 36, 30, 30, 33, 37, 45, 48, 48, 29, 29, 30, 31, 31, 34, 41, 41, 26, 28, 28, 31, 30, 33, 36, 36, 36, 37, 29, 36, 39, giving a mean rate of rising of 18 cm per minute.

(b) A second series of counts was made from the same material on 15.1.52 when the embryos were well developed (Apstein, stages 18–20). The temperature was again 9·5°C. It is possible that the density of the water had slightly increased due to evaporation in the incubator where they had been kept at 9·5°C. On this occasion

25 counts gave the following times in seconds for eggs to rise 10 cm.

26	24	24	20	21
30	27	26	21	22
32	25	21	22	22
26	25	22	22	22
26	27	30	24	23

with a mean value of 24·40 seconds and a speed of rising 24·59 cm per minute.

(c) On 4.1.52 seven counts were made on eggs caught in a surface tow net at 34·96‰ salinity and 9·0°C and kept at 9·5°C. On this occasion the eggs were timed through 5 cm and gave values of 30, 30, 33, 41, 46, 101, 45 seconds or a speed of rising of 6·4 cm per minute. The eggs were in various stages of development but chiefly about Apstein's stages 7–11.

These observations would suggest that in still water plaice eggs laid close to the bottom would have risen above 2 fm from the bottom in an interval of between one hour and 16 minutes. At a rate of 18 cm per minute they would reach the surface in 30 m of water in about 3 hours. If this movement out of the bottom layers was a regular feature of plaice eggs in this area then the arithmetic correction would be more often a source of error (giving overestimates) than a useful correction. Some evidence is however available on the vertical distribution of plaice eggs in this area. Buchanan-Wollaston (1926) made horizontal hauls for plaice eggs at the surface, mid-water and bottom, and came to the conclusion (p. 12) that "Eggs after extrusion usually become fairly regularly distributed in all depths of water. . . ."

On the 8 and 9 March 1952 a series of observations was made on the vertical distribution of fish eggs and larvae in the southern North Sea over a period of 24 hours. Open townets were attached to a weighted rope such that they were hauled horizontally 1½ fm above the bottom, at midwater and at 1½ fm below the surface, in water of about 20 fm depth at a position approximately 52°35′N and 3°15′E.

Hauls were made at 2 hourly intervals. The time was taken as each net entered and left the water, to determine the time that each net was fishing in different water levels during the shooting and hauling. A flow-meter was used in the midwater net.

The catches of the midwater and bottom nets were adjusted for the time they were passing through the upper levels, and all catches were scaled to a 500 m drag. The eggs at different levels were at approximately the same stage of development and predominantly in group I. Table I sets out the adjusted catches, scaled to totals of 100 for each set of three hauls. Hauls at 2230, 0030 and 0830 hours have been omitted, as fewer than a total of 25 eggs were caught on each of them. During the observations and for the preceding 24 hours the wind and sea were at forces 4 to 5 on the Beaufort scale.

In view of the small number of eggs caught and the variability in the catches at different levels on successive hauls it is not possible to be dogmatic about the conclusions. However, although the net near the surface caught 25% more eggs than the nets at midwater and

Table 1: *The vertical distribution of plaice eggs at approximately* 2 *hourly intervals over a period of* 20 *hours. The catches, at* 2 *m below the surface, midwater and at* 2 *m above the bottom, have been scaled to give totals of* 100

	Time G.M.T.								
	1430	1630	1830	2030	0230	0430	0630	1030	*Average*
Surface – –	27	43	48	24	47	40	35	11	34
Midwater – –	32	25	22	35	22	22	39	30	28
Bottom – –	41	32	30	41	31	38	26	59	37
No. of eggs caught	34	56	64	34	45	63	69	27	

near the bottom, it would appear that the water near the bottom contained a concentration of eggs only slightly less than the average concentration for the whole water column. Therefore the application of a correction for the unfiltered bottom 2 fathoms is required and a correction on the basis of the bottom 2 fathoms having the same concentration of eggs as the average of the rest of the column would be as accurate as is practicable.

These observations must mean that the vertical mixing of the water in the Southern Bight is sufficiently great to counteract the tendency for the eggs to rise to the surface by their own buoyancy.

2. ERRORS DUE TO OFF-VERTICAL HAULS IN BAD WEATHER

The major source of error with vertical hauls carried out during winter in northern latitudes lies in the increased column of water filtered when the drift of the research ship, due to the action of wind and waves, causes the net to rise obliquely.

As the typical winter weather during the spawning period of the plaice includes many days in which the wind rarely falls below Beaufort force 3, errors due to off-vertical hauls have to be taken very seriously, particularly as the errors are always positive. It usually occurs that the majority of the hauls in at least one out of the surveys in a winter have to be carried out in wind forces above Beaufort force 3. To wait for winds below this force would mean that in many years whole surveys would have to be abandoned, making the remaining ones of little use.

In years of continued bad weather, or when by chance the majority of the surveys fall in bad weather periods, the increased catches due to drift will increase materially the estimates of total egg production for the year.

Fig. 3 shows the approximate behaviour of the net during a 'vertical' haul when the ship is drifting through the water at a speed of 1 knot and 20 fm of rope are being used in sea 22 fm deep. By the time the descending net has carried out the 20 fm or 120 ft of rope, i.e. 15 seconds, the ship will have drifted 25 ft and therefore the net will only descend to

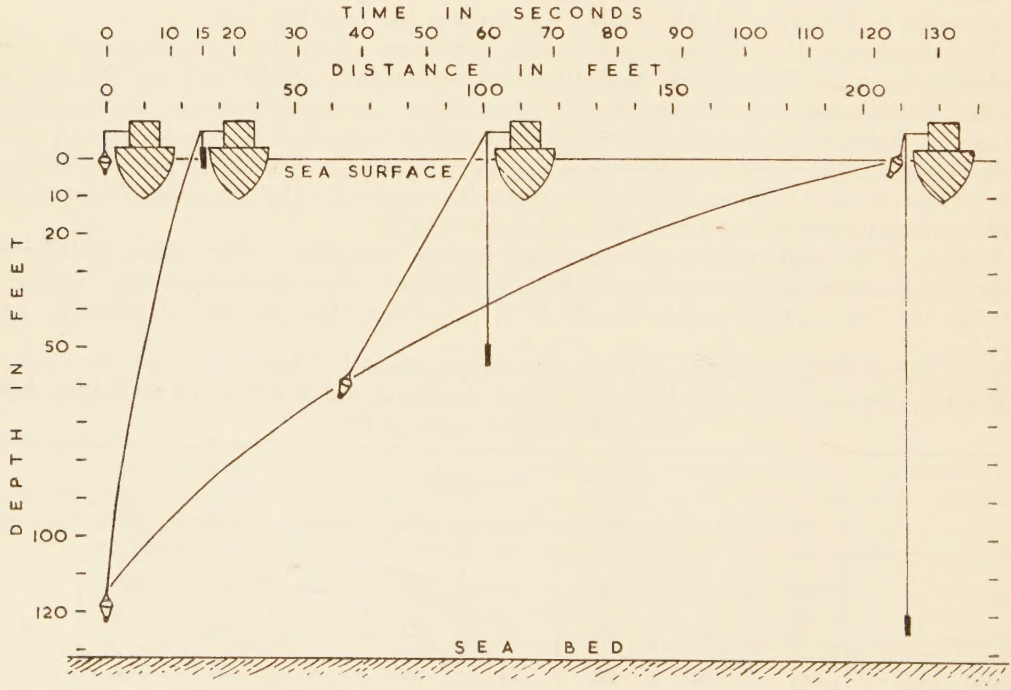


Fig. 3. *The probable path of the Hensen net during an off vertical haul due to the ship drifting at the exceptionally high speed of* 1 *knot while the net is hauled at* 1 *m per three seconds.* (1·09 ft/sec).

117 ft. On rising due to the pull of the counterweight, the net rises obliquely owing to the drift of the ship. In this case the total distance travelled during the rise, i.e. in 125 secs, is about 240 ft, just double the distance that would have been covered with no drift of the ship. However, owing to the weight of the net frame and brass bucket, the mouth of the net comes up at an angle between that of the rope and the vertical and therefore filters a volume of water considerably less than double that filtered during a truly vertical haul.

The increase in the volume of water filtered, due to drift, was estimated in 1949 by using a flow-meter* in the mouth of the Hensen net and determining the actual water column filtered and comparing it with the length of the hauling rope in the water at the start of each haul. In this way it was possible to calculate the percentage increase in the amount of the water filtered and relate it to the wind force and state of the sea on the Beaufort scale, data which has always been recorded as a routine at all stations worked by the Ministry's research vessels. This allowed the older data to be adjusted in the same way, assuming that the previous research ship the GEORGE BLIGH drifted at a similar speed in the same wind force and state of the sea. This assumption is considered to be justified by those who have used both ships, though it is possible that the drift of the present research ship, SIR LANCELOT, is slightly greater than was that of the GEORGE BLIGH, for comparable conditions of wind and sea.

Wind and Sea Beaufort	*Angle of rope from vertical*	*% increase of catch*	*Correction factor used*
3 slight	0 – 10	8	nil
3 – 4	5 – 15	23	×0·81
4 moderate	10 – 22	33	×0·75
4 – 5	20 – 30	43	×0·70
5 rough	25 – 35	59	×0·63
5 – 6	30 – 40	72	×0·58
6 very rough	> 40	82	×0·55

The corrections in column 4 have been applied to all data given in this paper except those for 1914 for which the wind and sea strengths have not been traceable.

It is seen that any survey carried out under conditions of wind and sea of 4 to 5 on the Beaufort scale, which has happened several times, would result in egg counts over 40% in excess of the real values.

3. ERRORS DUE TO CLOGGING OF THE NETS

In December to early March the plankton in the southern North Sea is very sparse and the total catch from a vertical haul of the Hensen net rarely reaches 2 cm thick when preserved in a 1-lb honey jar. Only in mid- and late March do *Phaeocystis* or small medusae become sufficiently abundant to cause any clogging of the sampling gear. By the time that clogging becomes a problem there are few plaice eggs remaining in the areas covered by these surveys.

Practically no trouble has in fact been experienced from clogging of the nets during these surveys and no correction has been applied.

B. THE ANALYSIS OF SAMPLES

1. SORTING

All samples from the Hensen net hauls were preserved in 2% formalin. The picking out of the fish eggs and larvae was facilitated by pouring each sample into a 6″ petri dish with ¾″ sides and placing it over a 10″ × 10″ sheet of ¼″ black perspex across which lines had been scored 1 cm apart with a sharp metal point, the lines being filled with white waterproof ink. This lined sheet gave a black background which was found most suitable for

*Supplied by Dr. Harvey of Plymouth Laboratory.

sorting fish eggs and larvae, while the white lines allowed one to work over the contents systematically.

After separation from the other plankton all eggs and larvae were examined under the microscope and recorded according to species, the plaice being, in addition, graded according to their stage of development. The examination under the microscope was facilitated by the use of a special slide based on that used by Buchanan-Wollaston (1911, p. 210), but made largely out of perspex, as follows. The base (Fig. 4) was a sheet of perspex $4'' \times 2'' \times \frac{1}{8}''$

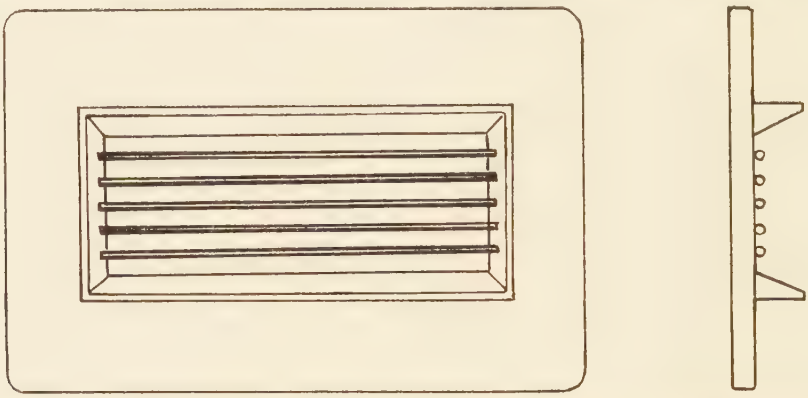


Fig. 4. *Top view and cross section of slide made of perspex and glass rods used in the staging of the eggs. Overall size* 2 *in by* 3 *in.*

to which were attached walls of nearly triangular section, cut and shaped from $\frac{1}{4}''$ sheet perspex. Each longitudinal partition was made from lengths of drawn glass rod set into notches in the end walls, and set just sufficiently far apart to take the largest plaice eggs. The parts were joined together with perspex cement. The slide held about 200 plaice eggs at a time, allowing their systematic examination and measurement if required. The sloping sides of the cell eliminated distortion due to the curved edges of the meniscus, since they were removed outwards from the area carrying the eggs.

2. STAGING OF THE EGGS

Buchanan-Wollaston's methods of staging have been followed as closely as possible in order to make the present data directly comparable with his published and unpublished data. A few changes in detail have, however, been made to facilitate the work. The procedure, with the modifications, is briefly outlined below.

Apstein's 25 stages of development (Apstein, 1909) have been used as the basis of analysis of all the material reported upon here and by Buchanan-Wollaston. These stages and the 'groups' of stages explained below are shown in Fig. 5; this figure also shows graphically the relation between the stages of development time and temperature, derived from Apstein's tables. Buchanan-Wollaston used two slightly different groupings in his analyses. The 1935–39 material was analysed by Buchanan-Wollaston into five groups (I–V) of Apstein's stages; with I being sub-divided into IA and IB. Group IA is Apstein's stages 1–3, as used previously by Buchanan-Wollaston for his 1911, 1914 and 1921 published data, but group V is Apstein's stages 22-hatching, instead of the 20-hatching, used by Buchanan-Wollaston for his 1921 data. The present writer has used these five stages (with the first sub-divided) as used for the 1935–39 material. The original counts of eggs for the years 1935 onwards are set out in the Appendix. It should be noted that in Buchanan-Wollaston's method, and therefore also in this paper, group IA means all eggs up to a state of development halfway between Apstein's figures of stages 3 and 4; similarly group I (A and B) includes all states of development up to halfway between Apstein's stages 6 and 7. Group V includes all eggs which have passed a state of development halfway between Apstein's stages 22 and 23. It is unfortunate that the actual stages defined by Apstein's drawings were

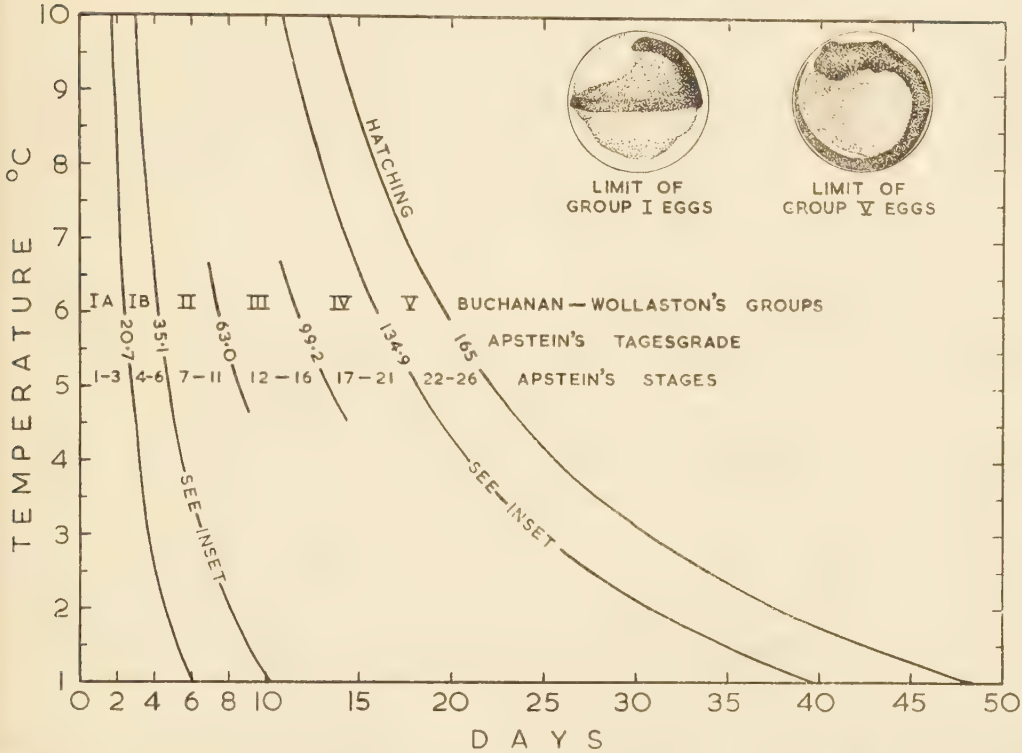


Fig. 5. *The relation between temperature and the development of plaice eggs, derived from Apstein's tables. The limits of Buchanan-Wollaston's groups I and V are shown by the inset drawings.*

not used by Buchanan-Wollaston as the limits of his groups, since it has meant that the present writer has had to guess the actual limits of Buchanan-Wollaston's stages. The limits taken for the material analysed since 1939 are illustrated in Fig. 5. In words, the limit to group I (stages 0–6½) has been taken as the state when the margin of the blastopore forms an equator to the egg and group V (stages 22½-hatching) begins when the tail of the embryo is long enough, when lying on the equator of the egg, just to touch the snout.

3. DRAWING THE CONTOURED CHARTS

For the determination of the spawning area and the numbers of eggs spawned Buchanan-Wollaston used eggs of group IA only, and drew contours on his charts of egg distribution at values of 7·5, 15, 30, 60 and 90 eggs per m². The material from 1934 to 1936 contained many fewer eggs and using group IA alone would have meant that only some 30 eggs could have been available for the whole of the 1936 estimations. To reduce sampling errors due to such small numbers it was found necessary to use at least the whole of group I eggs. This has consequently been adopted for all the new material, and as the raw data was available for 1914, the 1914 charts have been redrawn using group I eggs.

The small numbers of eggs involved in the 1934 to 1939 data also meant that often the area of sea with fewer than 30 eggs per m² was very large and that the use of only two egg contours below 30 would have given a very incomplete picture and would have made the calculation of total eggs present very inaccurate. Consequently the intervals between contours have been reduced by using values of 1, 5, 15, 25, 35, 45, 55 etc. In order to use all available data the 1914 and 1921 material has been recalculated on this basis. The full original numerical data for 1911 unfortunately are no longer in existence.

Buchanan-Wollaston used a precise graphical method of determining exactly the positions of the egg contours between the plotted values found at the stations. This method aimed at

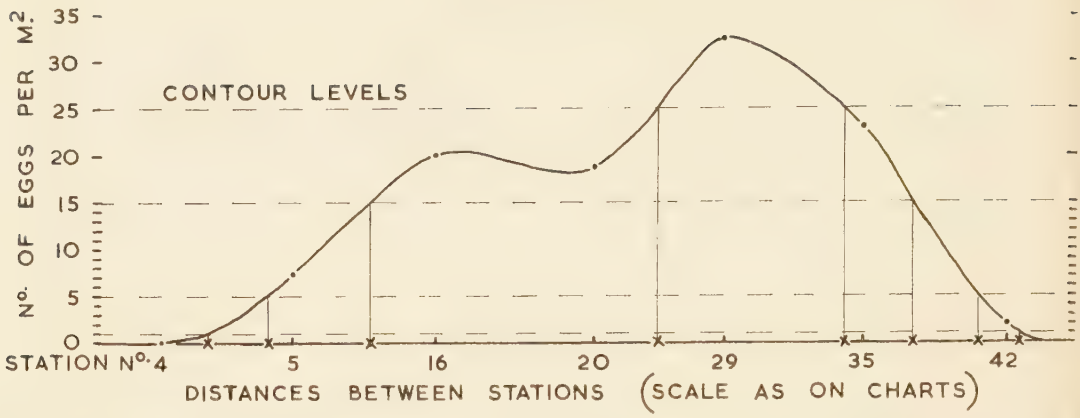


Fig. 6. *Example of the method used to locate the positions of the contours between the stations on the charts of plaice egg distribution. The crosses show the positions on the lines joining the stations where the contours of values* 1, 5, 15 *and* 25 *cross these lines.*

eliminating completely the personal factor involved in contour drawings (Buchanan-Wollaston, 1923, 1926). The method used here is based on the same theory but is much quicker and nearly as reliable. As in his method, each straight or nearly straight line of stations is taken in turn and the intervals between the stations are marked off successively along a base line on graph paper. On the position of each station is erected an ordinate line equal in length to the number of eggs per m^2 at that station. Through the upper ends of these lines a free-hand parabolic curve is drawn. From this curve the positions between the stations corresponding to the contour values can be read off. This is illustrated in Fig. 6. This method differs from that of Buchanan-Wollaston in that the parabolic curve is drawn free-hand instead of being determined by geometrical construction. The full method using the geometrical construction is, however, very useful at the start in order to get practice in drawing parabolic curves free-hand. The contours are then drawn free-hand through these new points interpolated between the station positions on the chart. This method has been used to draw all the charts in this paper. No attempt has been made to close contours if stations are not present in the areas concerned. However in certain cases, especially along the east and west boundary of the area, where the limits of egg distribution have been found to be remarkably constant, the contours have been closed with a dotted line when their precise position is in doubt.

The charts showing the distributions of group I and group V eggs for all surveys are set out as Appendix Figs. I–X at the end of this paper. Additional material is set out as charts in the text.

C. CALCULATIONS

The contoured charts of the distribution of group I eggs have been used to calculate the number of eggs of this stage present at the time of each survey. Knowing the mean age of these eggs from Apstein's curves of age, stage and temperature the daily rate of egg production has been obtained. These figures of daily egg production for each of the surveys of a year have next been plotted against time to give a curve of egg production from the area, from which can be obtained the total egg production for the year.

The details of the methods involved are here described.

1. Starting with the contoured charts of the distribution of group I eggs per m^2, the area within each contour has been obtained by making two runs round each contour with a planimeter, and taking their mean.
2. These areas were next plotted against their contour values and the points joined by a smooth curve. The area below each such curve gives the product of the contour value

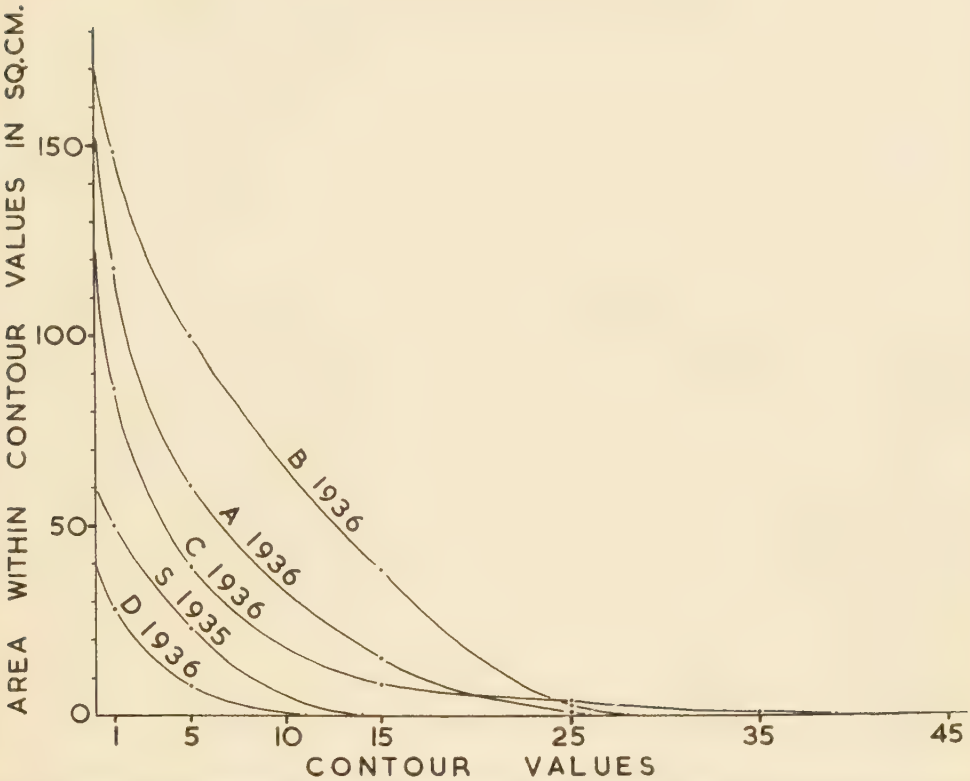


Fig. 7. *Examples of the method used in determining the daily egg production from the contoured charts of egg distribution. See text.*

and the corresponding area, and hence a figure for the total eggs present at the time of the survey. As an example the five curves for the surveys of 1935/1936 are shown in Fig. 7. The area below each curve was again determined by making two runs with a planimeter. By multiplying the value obtained by a factor appropriate to the scales of the chart and of the graph paper a figure for the number of group I eggs present at the time of the survey was obtained. Each such figure will represent egg production over varying periods of about 3 days, according to the rate of development of the eggs, which in turn is dependent on the temperature.

3. To convert these figures to daily egg production they were divided by a factor derived from Apstein's table corresponding to a mean temperature of the sea water at the time of the survey. The mean temperature used for each survey was derived from a careful visual inspection of the temperature and egg distribution such that the figure took into account both the total range in temperature over the area in which eggs were found and, more particularly, the temperature in the area where eggs were most abundant. The temperatures used are plotted as Fig. 8 and thus show the changes in temperature during the spawning period for each year in which egg surveys were made.

   It would be more accurate if the egg number at each station had been adjusted for the temperature at that station, but since in some of the earlier years temperatures were not taken at all stations, the present method was adopted.

4. The annual egg production was obtained by graphing the figures of daily egg production at the time of each survey against time, and once more obtaining the areas below the curves.

   In several years the number of surveys was inadequate to define the shape of the curve of annual egg production with precision. In particular the absence of surveys early and late in the season in 1914 and 1921 made the positions of the ends of the curve in these years uncertain. However, as the curves for years in which early and late surveys were made, showed considerable constancy in the dates of the start and finish of spawn-

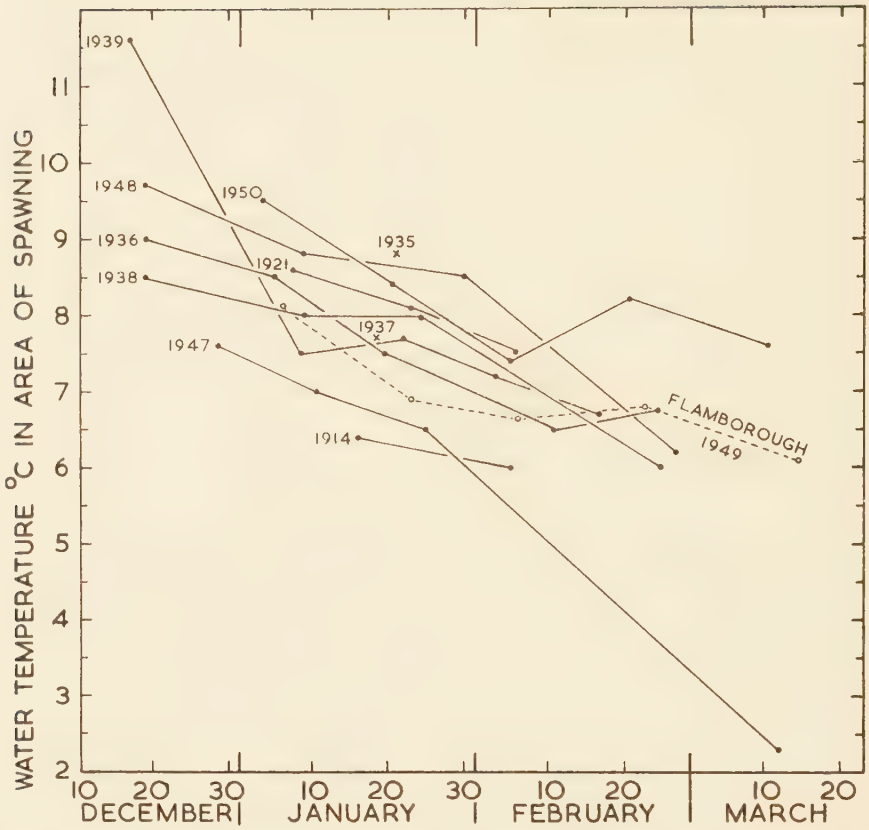


Fig. 8. *The average temperature in the area of spawning within the Southern Bight (and Flamborough area in* 1949). *Each point was derived from one survey.*

ing (see p. 20), about 11 December and 1 March, these dates have been used to complete the curves where necessary. The curves of daily egg production are given in Figs. 18 and 20, and the lines are broken where there is uncertainty of their shape due to inadequate surveys.

D. ACCURACY OF ESTIMATES OF ANNUAL EGG PRODUCTION

Reliable estimates of the accuracy of the figures of annual egg production are very difficult to obtain; in fact, in the absence of replicated surveys, it is not possible to make quantitative estimates of their reliability. The major sources of error in the method are therefore discussed to see whether important errors can be anticipated.

Errors will arise from the fact that the catch at each station is taken as an estimate of the abundance of eggs over an area which has been typically over 100 square miles in extent. These errors will be as often positive as negative, and, provided the number of stations is large, the total error will tend to be small. It does however appear that in 1938 the figure obtained for the total egg production in that year was too high (see p. 32) and this may have arisen partly from the number of observations in the area of greatest spawning being inadequate. The number of hauls with group I eggs, used in the estimations for the various years, have been as follows:—

1914	1921	1935	1936	1937	1938	1939	1947	1948	1949	1950
35	113	41	94	37	48	62	150	251	83	264

Non-directional errors will also result from the use of a planimeter in measuring the areas of contours and of graphs. These errors, it is considered, will be insignificant.

Directional errors will arise from bad weather always tending to increase the catch of eggs due to the drift of the ship turning the vertical haul increasingly into an oblique tow. As described, allowance has been made for this error, but no assessment of the efficacy of the correction has been possible.

A second directional error is that due to mortality of the eggs during the stages used in the calculations. These errors will all give under-estimates of the number of eggs laid. The total mortality during the development of the eggs has varied between 25% and 75%. The time taken to reach the middle of group I is $\frac{1}{9}$ of the life of the eggs; therefore if mortalities were uniform throughout development, the numbers of group I eggs would have been reduced on average by a mortality of between $\frac{1}{9} \times \frac{1}{4}$ or $\frac{1}{16}$ or 3%, and $\frac{1}{9} \times \frac{3}{4}$ or $\frac{1}{12}$ or $8\frac{1}{2}$%. These mortalities may be expected to be overestimates, as eggs of stage I have not yet reached such a stage of epiboly that they are subject to damage by shaking as described by Rollefsen (1932), nor has any pigment been developed such as must be important for the herring to be able to see and devour them.

Finally, the necessity of drawing arbitrary limits to the Southern Bight spawning area, which is in fact continuous with the extension into the English Channel and with a variable degree of spawning just north of 53°N, creates a certain inevitable artificiality to the spawning area.

III. THE TIME AND POSITION OF SPAWNING

In 1909 Masterman summarised the knowledge then available concerning the spawning grounds of the plaice in the North Sea, south of 57°N (Masterman, 1911). At that time evidence from the distribution of plaice eggs, spawning fish and of areas of high male: female sex ratio, had shown that there existed spawning areas in the 'Flemish Bight', the Flamborough Off area, and over an extensive area between the Dogger Bank and Helgoland, but their positions and relative importance were only very roughly known.

Since that time Buchanan-Wollaston's three reports have defined much more accurately the first and chief of these areas, while recent German papers have made considerably more precise our knowledge of the limits of the Helgoland spawning area.

The new data presented here covers the extension of the Southern Bight spawning area into the English Channel and the spawning in the Flamborough area, with the result that it is now possible to review the distribution in time and space of the spawning in all parts of the North Sea. However before doing so it is necessary to discuss the accuracy of the deductions made, since the drift of the eggs in the interval between their being laid and their being caught will at times be considerable.

The use of eggs of group I only, for the determination of the spawning areas, reduces the interval during which the eggs are drifted from the area in which they have been spawned. However at the lower temperatures this interval covers several days.

From Fig. 8 it is seen that the mean temperature in the Southern Bight spawning area varied from year to year, but was rarely above 10°C at the start of spawning or below 6°C at the end. 7·5°C may be taken as a generalised mean temperature in the area of spawning in the Southern Bight. At 7·5°C it takes plaice eggs 4·2 days to pass through group I, while at 6°C it takes 5·5 days (Fig. 5). While the average age of eggs in this group will usually be less than half these figures, we may occasionally get catches of group I eggs that have an average age of about 5 days. On an average the daily drift of eggs in the spawning area has been found to be about 2·4 miles per day in a north-north-easterly direction (section VIII), but reaching at least 5 miles per day during gales. Thus while on an average the displacement of eggs due to residual current will be about 5 miles, a displacement of over 20 miles may be reached in cold areas during gales. As the main axis of the Southern Bight spawning area runs approximately north-east the lateral boundaries of the spawning area will remain

accurate. However, the north-easterly boundary will sometimes appear somewhat further north-east than is true.

The tidal movement in the Southern Bight spawning area will have a small but definite effect on many observations. The admiralty charts show that, due to tides, the water moves in an elongated ellipse, whose long axis, running in a north-easterly direction, may reach more than 8 miles during spring tides. Thus in half a tidal cycle eggs may be displaced as much as 8 miles from the point at which they were spawned, giving under extreme conditions a total displacement of 28 miles due to wind and tide. Summarising, the eggs caught at any one station are more likely to be displaced by tide and drift in a north-east or south-west direction than at right-angles to this axis. While displacements of 5 to 10 miles may be frequent, displacements may occasionally reach 20 to 30 miles in a north-easterly direction under extreme conditions.

A. THE SOUTHERN BIGHT SPAWNING AREA

Buchanan-Wollaston's earliest plaice egg surveys, made in 1911, were sufficiently frequent and extensive to show that spawning lasted approximately from December to March and that the peak spawning occurred in late January or early February. The surveys that were made in 1914 and 1921 were limited to January and early February, and although they gave a more quantitative estimate of the egg production and the position of spawning near the time of peak spawning, they did not give more information on the time or position of the start and end of spawning. The 1935–1939 surveys, and those carried out in 1947–1950, have added a good deal of information on these points as well as providing more information on the extent of the variation in the time and position of spawning from year to year.

LIMITS OF THE AREA

The surveys in 1947 defined precisely for the first time the western limits of this spawning area. Earlier surveys (1935–1939) showed that the Southern Bight spawning extended west

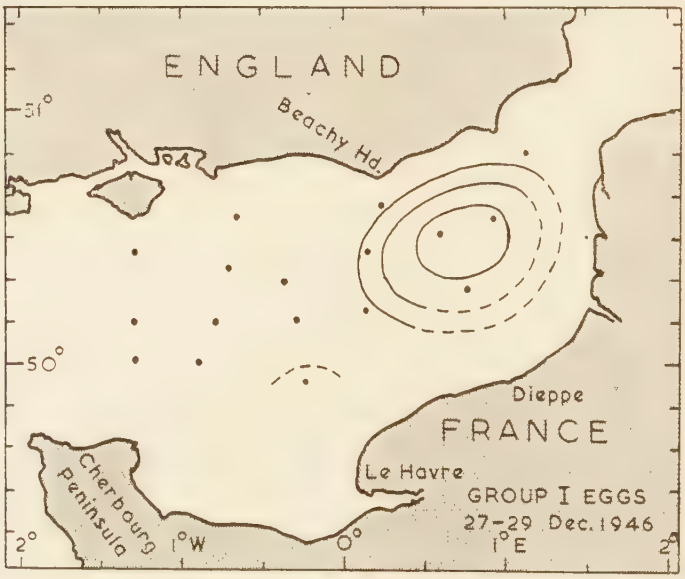


Fig. 9. *The eastern end of the English Channel showing the distribution of group I plaice eggs below* 1m^2 *found on the survey of* 27–29 *December*, 1946. *Dots show station positions. Contours at* 1, 5 *and* 15 *group I eggs below* 1m^2.

through the Straits of Dover into the English Channel, but the most westerly line of stations, from Beachy Head to Dieppe, had rarely been sufficiently far west to close the egg contours in this area. The survey in December 1946 was worked as far west as the Isle of Wight (1°15′W) and showed clearly (Fig. 9) that spawning in this area did not extend further west than about the Greenwich meridian, which passes some 10 miles west of Beachy Head. There were however a few plaice eggs at a station (49°55′N 0°12′W) on the edge of a minefield which at that time barred progress to the south, which suggests that there is probably some regular spawning between Le Havre and the Cherbourg peninsula.

The following two surveys in that winter, 9–12 January 1947, and 22–28 January 1947 were carried westwards until not more than a total of 5 plaice eggs of all stages of development were caught in 3 hauls of a Hensen net at any one station in any one time of a series of nearly north-south lines, some 12 miles apart. Bad weather and a small ship, the 90 ft M.F.V. PLATESSA, necessitated the number of stations worked being kept to the absolute minimum, or stations would have been worked further west. The results of these two surveys confirmed that the spawning in the eastern English Channel was limited to an area east of 0°, and that in effect this spawning area was a 'spill-over' from the main spawning area in the southern North Sea, and did not extend more than 50 miles west of the straits.

During the 1939–45 war the plaice that did come through into the English Channel formed a highly profitable winter fishery for the small fishing boats working out of Rye. The plaice were caught as spawning fish in the off-shore grounds, but particularly as large spent fish on the coastal fishing grounds off Rye (Wimpenny, 1947). That these plaice were primarily part of the North Sea stock has since been shown by marking plaice off Rye in

Fig. 10. *The outer limits reached by the 5 group I eggs per m² contour each year.*

different seasons. The majority were recaptured in the North Sea and only a very small percentage were caught more than 10 miles to the west of the position of marking (Wimpenny, 1953).

The evidence for the spawning area west of the Straits of Dover being quite continuous with the North Sea spawning area is not conclusive. On several surveys the distributions of group I eggs in those two areas could be linked by a narrow neck of eggs, but the tidal movement in this funnel shaped area is so great that discontinuities of 10–20 miles in the actual spawning area might readily be masked by the tidal transport of eggs over these distances.

Fig. 10 has been drawn to show the outer limits of spawning for the eight years for which fairly complete data are available. Each line gives the limits reached by the 5 group I eggs below 1 m^2 contour, for all the surveys in one year combined. It is seen that the spawning giving rise to this density of eggs, and comprising over 90% of the eggs in any year, occupied each year most of the central part of the Southern Bight. The limits on the eastern side typically extended into water of about 12 fm depth while on the western side the limit occurred in water reaching some 24 fm. To the north-west the edge of the spawning cuts obliquely across the deeper water (about 24 fm) known as the 'Western Deep'. Few plaice eggs are ever found in the vicinity of the Smith's Knoll light vessel which stands on the north-west edge of the deeper water. In fact the limits in this area, while possibly governed by depth in the east, certainly must be governed by other factors in the west.

North of 53°N the distribution of group I eggs varied somewhat from year to year, the eggs never being in large numbers, but often fairly widespread. No doubt the effects of

Fig. 11. *The positions of the areas of maximum egg production each year as determined by the positions of the higher valued contours of group I eggs.*

water movement in this more open part of the sea will have carried the eggs about more than further south and blurred the edges of the real limits of the spawning in this area, if in fact there are regular limits here.

In 1921 and 1948 and also to a less extent in several other years, group I eggs extended eastward, suggesting a link with the spawning in the Borkum area. This link between the Southern Bight spawning is clearly seen from the observations of Aurich (1941) and Bohl (1954) whose observations are set out as Figs. 30–32. In the surveys of 1921 and 1948 there were also extensions of the distribution of group I eggs northward.

Fig. 11 has been drawn to show the area of maximum spawning in the Southern Bight for all years for which data are available. Each line corresponds to one of the higher contour values on that survey each year which occurred closest to the peak of spawning in that year. The variation in amount of spawning over the years surveyed gave great variation in the areas covered by any particular one of these higher valued contours and therefore, for this diagram, contours of different values were selected each year to give comparable sized areas. The positions of the contours given are seen to fall within a fairly well defined area, having a centre of gravity at about 51°55′N and 2°50′E. There appears to have been no tendency for the centres, or the limits of spawning, to show any movement in one direction over the period between 1914 and 1950.

While the centres of maximum spawning have fallen within this limited area, the centres themselves do not by any means coincide. For instance in 1914, 1948 and 1950 the greatest spawning lay a good deal to the west of the greatest spawning in 1921 and 1937.

Buchanan-Wollaston found that the distribution of young plaice eggs did not remain constant throughout the spawning period but that it moved steadily to the north-east as spawning progressed. This observation has been definitely confirmed by the later data. Figs. 12 to 16 show this progressive movement. The surveys have been grouped according to the dates on which they were made, irrespective of year, and show the positions of spawning at approximately fortnightly intervals throughout the spawning period. It is seen that at the start of the season spawning was limited to the eastern English Channel and into the southern North Sea as far as 52°N. During January the spawning spread northwards until, by the second half of January, the peak was reached and spawning was centred on about 52°N. Up to mid-January the spawning in the North Sea each year has typically been one clearly defined similar area with a simple outline. During late January and February the spawning, while moving further north-east, has tended to split up with two or more centres whose positions have varied from year to year. By the second half of February there has been practically no spawning remaining south of 52°N.

In the Southern Bight the spawning covers an area very largely of clean sand, with some gravel and patches of stones of glacial origin on the western side. This sandy bottom has been greatly affected by the intense tidal action in this funnel shaped sea, and south of about 52°30′N the bottom is in the form of ridges of increasing size to the south. Van Veen (1935) has described some of this topography in considerable detail and the saw-tooth appearance of the trace of an echo sounder in this area is very striking (Fig. 17). These sand waves while appearing very steep-sided on the echo sounder record are in fact relatively gradual though of considerable size. Thus over the greater part of the centres of spawning as shown in Fig. 11 the sand waves are some 300 feet between crests and there are 15 to 30 feet vertically between crest and trough. Recent studies of the form of the ridges, made by German scientists working from the GAUSS, have shown that individual waves do not continue far in any one direction, but divide or stop and are much like sand ripples on a large scale. The long axes of the waves run typically in a north-north-east to south-south-west direction.

Although the gradients on the sand waves are not great the ridges are sufficiently marked to make trawling with large heavy gear very difficult. Apparently the ground rope tends to cut into the ridges if the gear is being towed parallel with them and the net is torn away. This feature must have a considerable effect on conserving the spawning plaice which would otherwise attract a much greater fishery than now risks its gear in this area.

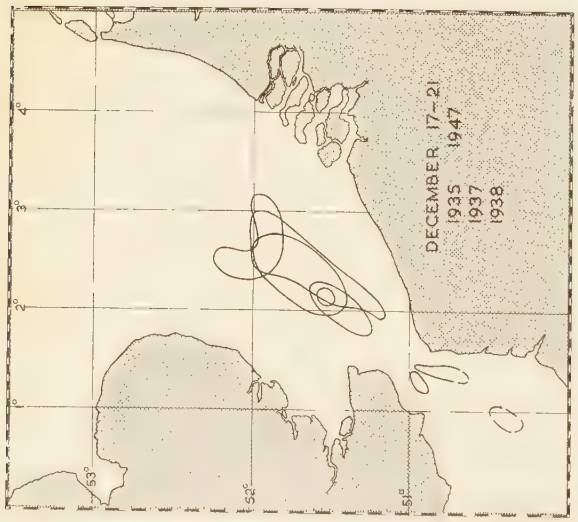


Fig. 12

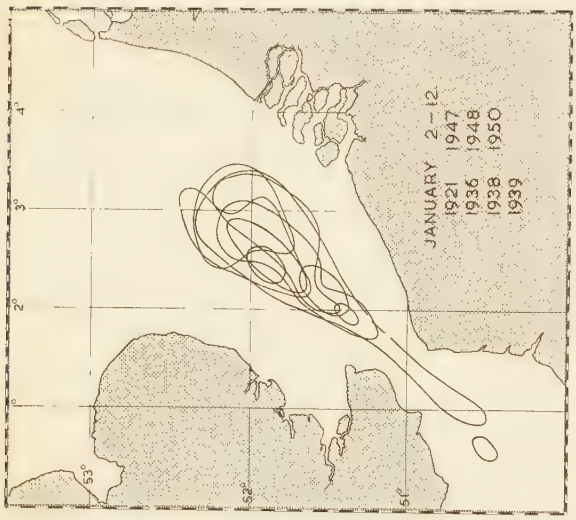


Fig. 13

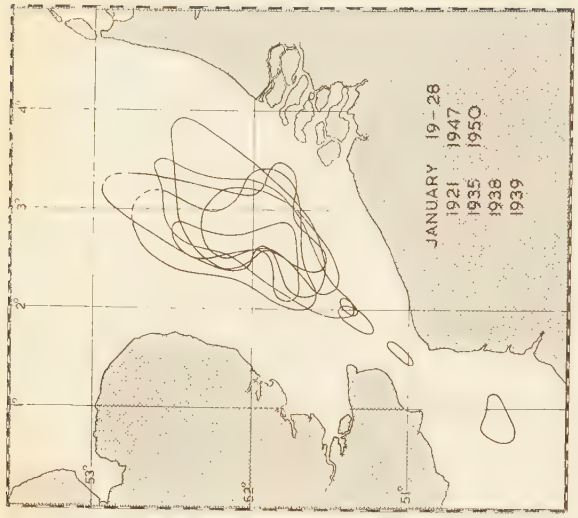
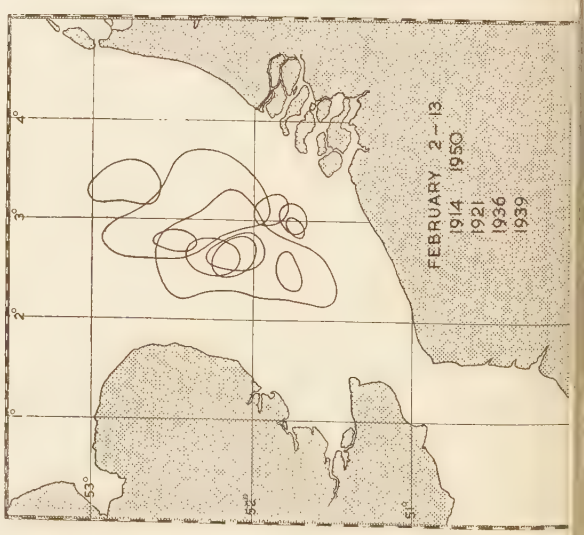
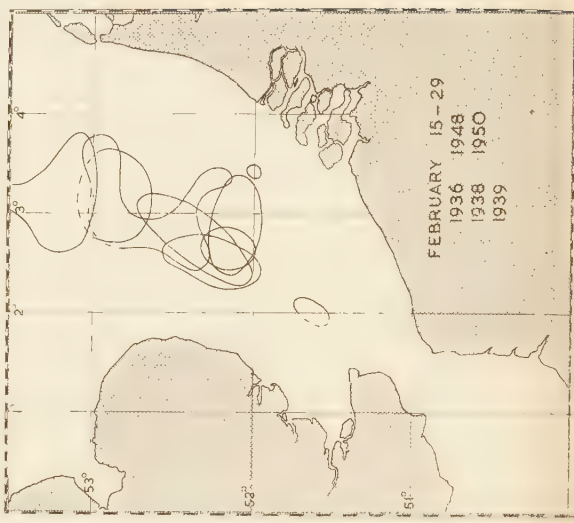


Fig 14





Figs. 12–16.

The progression of plaice spawning.

Charts showing north-easterly progression of the centres of spawning at approximately half-monthly intervals throughout the spawning period. The contours were obtained from surveys made in different years but carried out between the dates indicated. On Figs. 12 *and* 16 *the contours are of value* 5, *while on Figs.* 13 *to* 15 *they are of* 15 *group I eggs below* $1m^2$.

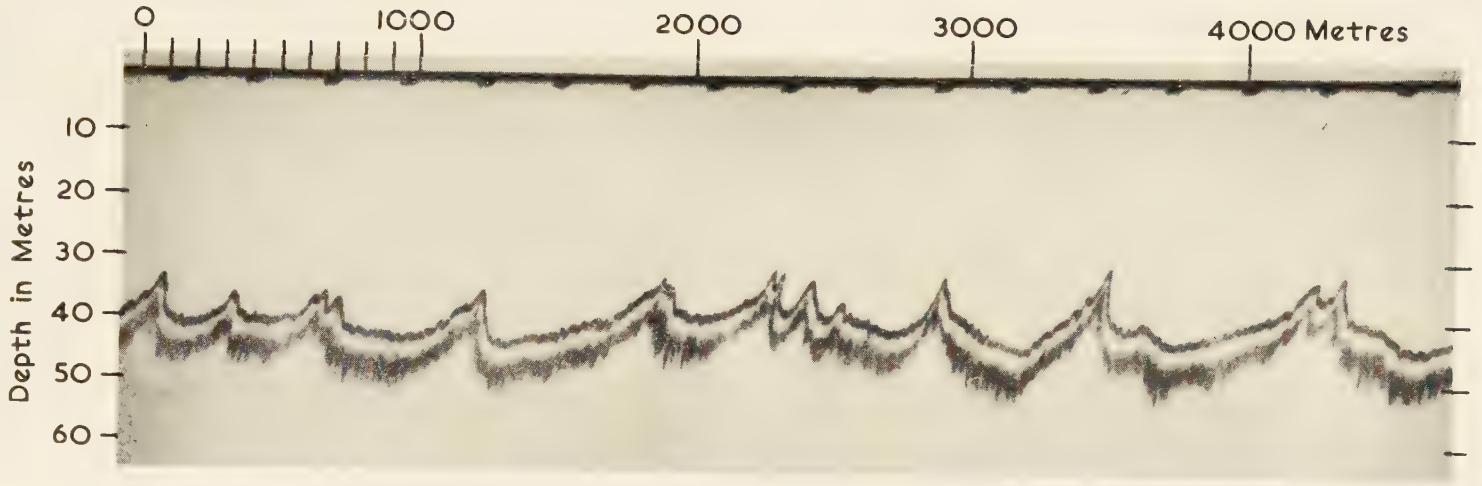


Fig. 17. *Part of echo sounder's trace showing the ridged nature of the sea bottom in the centre of the spawning area. The ship was at* 52°00′*N*, 3°00′*E, travelling east.*

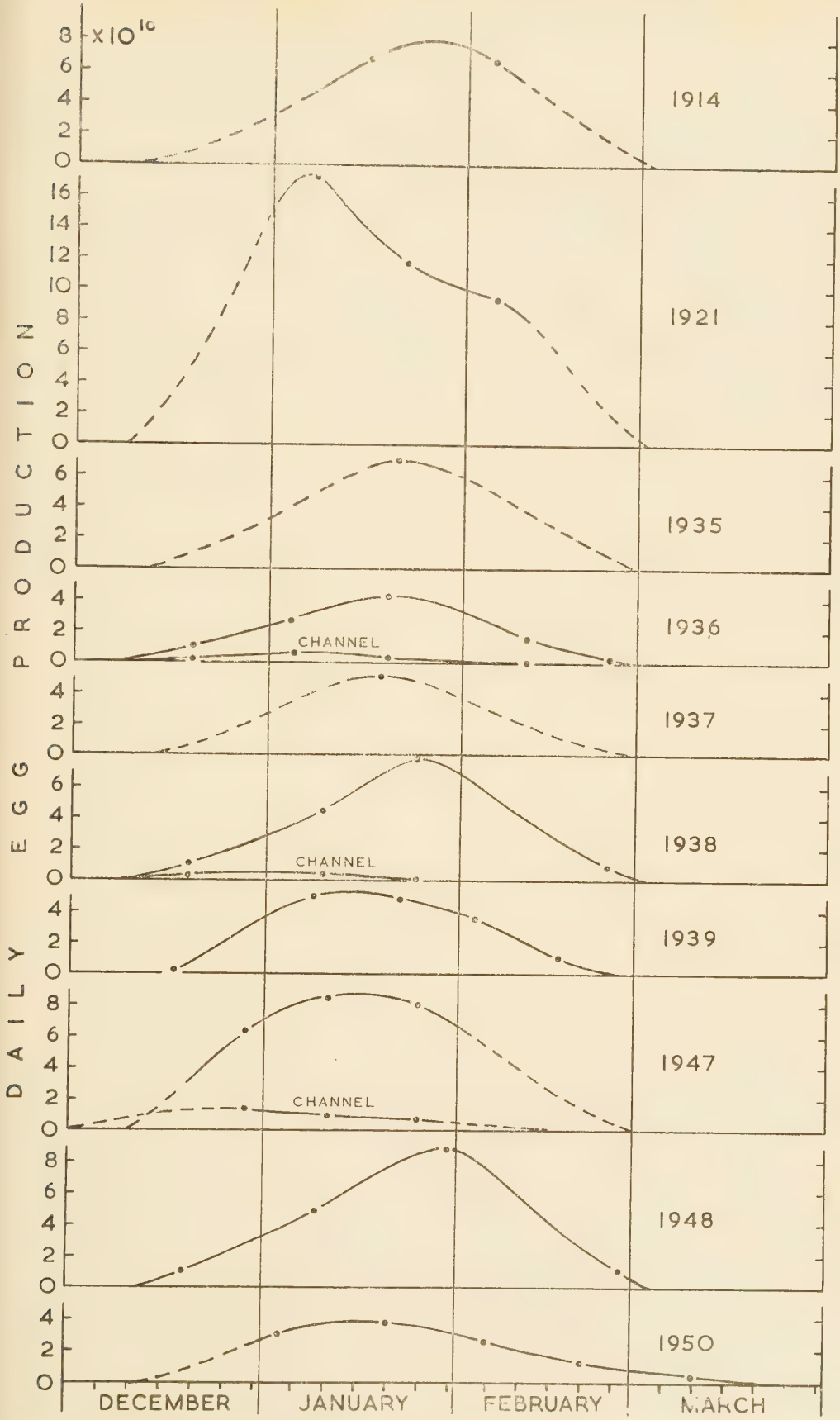


Fig. 18. *Curves of daily egg production in the Southern Bight between the Straits of Dover and 53°N, and in the eastern English Channel in 1936, 1938 and 1947. Each point is derived from the results of one survey.*

THE TIME OF SPAWNING

While the data just presented show that spawning in this area has started by the second half of December, reaches its peak in late January, and has almost finished by late February, the timing can be studied more precisely by using the graphs of daily egg production (Fig. 18), the preparation of which has already been described.

A feature of the daily egg production curves is their general simplicity of form, indicating a steady build-up and subsequent fall-away in spawning, though in different years the slope of the curves has varied considerably. The only real exception has been 1921 where the three surveys give points which do not allow the drawing of a simple curve of this kind.

Where the number of surveys has been adequate the curves do give useful data on the times of the start, finish and peak of spawning. Table 2 sets out these times.

The four years in which the start of spawning can be placed gave very similar dates between 7 and 15 December, with the mean at 11 December. While this gives a mean date for the beginning of spawning measurable by these methods, it does not mean that no plaice are spawning before this date. In fact individual spent females have been landed on the Lowestoft market from the Southern Bight as early as 20 November (1949), and Furnestin (1939) reports having caught plaice eggs from the Sandettie lightship(51°13′25″N, 1°53′39″E) on 22 November 1932. 11 December does, however, give an indication of the time when spawning becomes of significant proportions. Before that date the amount of egg production typically contributes much less than 1% of the eggs produced in the Southern Bight in the year.

Table 2: *Approximate dates of the start, peak and finish of spawning in the Southern Bight spawning area*

Year	*Start*	*Peak*	*Finish*
1914	–	24–28 January	–
1921	–	Before 7 January	–
1936	7 December	18–20 January	29 February
1938	10 December	25–26 January	2 March
1939	15 December	13–14 January	26 February
1947	–	15 January	–
1948	10 December	29–30 January	4 March
1950	–	15–17 January	20 March

Turning to the time at which spawning ends, the data for the four years 1936, 1938, 1939 and 1948 showed that spawning ended between 26 February and 4 March.

However, in 1947 and 1950 significant quantities of group 1 eggs were still being caught on surveys centred on 12 March and 20 March respectively. Extremely cold conditions during the spawning period are known to prolong spawning (Dannevig, 1930; Simpson, 1953) and no doubt this was the cause of the delayed spawning in 1947, when water temperatures in the spawning area fell to 2·3°C. However, the water temperatures in 1950 were above normal, which shows that factors other than low temperatures may from time to time result in the continuation of spawning in the area well into March.

The time of the peak of spawning varied considerably, occurring at dates well spread over the second half of January, from before 10 January (1921) to the end of the month. This peak date of spawning refers to the peak number of eggs liberated, but not necessarily the time when the largest number of fish are spawning, as the latter depends on whether the size composition of the spawning fish remains constant throughout the spawning period.

Data are presented in Section V that show a tendency in 1946 for the larger and older fish to spawn earlier than the younger fish. This would make the dates of the maximum numbers of spawning females later than the dates of maximum egg production. Such a variation in the time of spawning of fish according to age could, in fact, be part cause of the variation in the date of the peak of egg production, since in years of predominantly old fish, for instance 1921 and 1947, the spawning would be expected to be earlier than the average—as actually occurred. However, this could not explain the early spawning in 1939.

In view of the known effect of extremely cold winters in prolonging or delaying spawning it would be useful to examine whether sea temperatures regularly determine the time of peak spawning. Since the time of the start of spawning is very uniform and therefore apparently independent of variable factors such as the temperature it would seem appropriate to see if there is any correlation between the time of the peak of spawning and the sea temperature at that time or somewhat earlier, 1 January being taken for convenience. In Fig. 19 the dates of peak spawning have been plotted against the temperatures in the spawning area at the time of peak spawning and at 1 January.

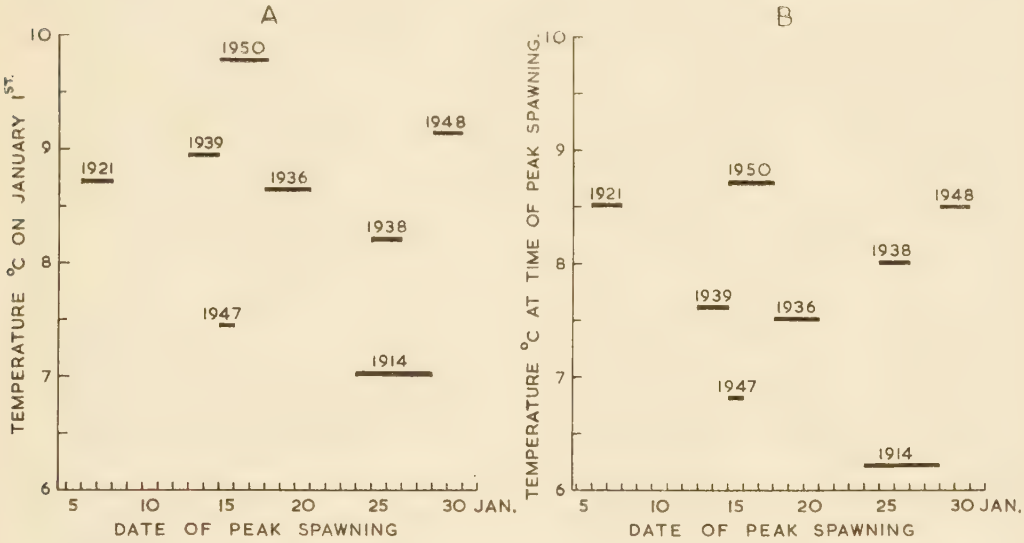


Fig. 19. *Graphs relating the date of peak spawning in each year with: A, the mean sea temperature in the area of spawning on 1 January in the same year, and B, the mean sea temperature in the area of spawning at the time of peak spawning.*

It is seen that there is very considerable scatter of the points and that in both diagrams peak spawning in years of high temperatures occurred at all dates from the earliest to the latest. However the absence of values at the bottom left hand side of the graphs could indicate that below average temperatures may have a delaying effect on the date of peak spawning, but there are too few observations to permit the drawing of this conclusion.

It will be useful here to pull together these observations on the Southern Bight spawning in the form of a brief summary.

Spawning becomes of measurable amount during the second week in December and continues up to the first week in March, with the peak of spawning varying from year to year, but usually occurring between 13 and 25 January. The centre of spawning usually lies about twenty miles south of 52°N during early January and moves north-east, and often splits up, the areas with most eggs in February being found slightly north of 52°N. The southern limit of the spawning area extends some fifty miles into the English Channel; the western limit lies along the western edge of the 'Galloper deep', and cuts north-east across the 'Western deep'; the eastern limit lies parallel with, and some twenty miles from, the Belgian and Dutch coasts in about twelve fathoms of water. The northern limit varies

considerably from year to year; when the spawning population is small, the main area does not extend as far as 53°N, but in other years spawning has been found to extend north towards the south-west end of the Dogger and north-east towards the Borkum spawning area.

B. THE FLAMBOROUGH AREA

Hefford (1909, 1916), Borley (1912), Wallace (1909), Masterman (1911) and Lee (1914) all found evidence of plaice spawning in the Flamborough area. The evidence, being in the form of high ratios of males to females and incidental records of the presence of running males and females, did not permit a precise definition of the spawning area nor the determination of its importance relative to the Southern Bight. Borley (1912, p. 40) found that of the plaice transplanted to the western end of the Dogger a large proportion of those recaptured in January to March were taken in the Flamborough area as spawning fish, and he therefore deduced that the main spawning area of the Dogger plaice was off Flamborough. To determine as precisely as possible the limits of this spawning area, a series of plaice egg surveys was carried out in 1949 to cover the Flamborough area on exactly the same lines as were used in the Southern Bight.

Five detailed surveys were completed between 5 January and 19 March, but as there were still some young eggs at the time of the last of these surveys the results of two plankton surveys in April, planned for a different purpose but covering part of the same area, were used to complete the picture. In Figs. 21 to 27 the distributions of Group I eggs are set out in just the same way as for the Southern Bight, and the graph of daily egg production based on the seven surveys is given as Fig. 20.

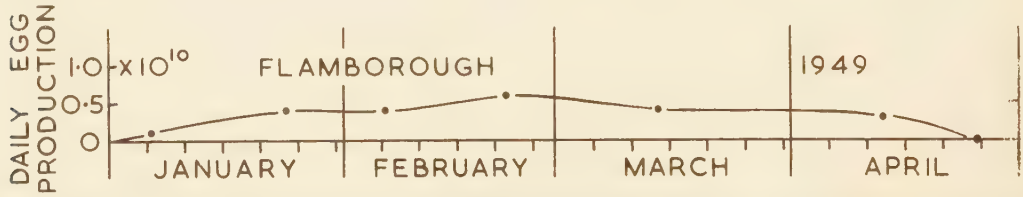


Fig. 20. *Curve of daily egg production in the Flamborough spawning area, excluding the spawning on the southern edge of the Dogger Bank.*

The area of eggs off the southern end of the Dogger and east of 2°E was only found on the third survey and is no doubt linked with the northern extension of the Southern Bight spawning observed in some years, and already described. A very limited but quite definite area of eggs was picked up on 5–11 January, 20–25 January and 4–8 February at 54°00′N, 1°30′E between the Flamborough Off ground and the Outer Silver Pit.

The main area of spawning was found to form an elongated oval area nearly parallel with the English coast, with its boundary, as determined by the limit of the 1 group I egg/m² contour, extending from 53°40′N to 55°20′N, and up to forty-five miles from the coast at its greatest distance (Fig. 28). As in the Southern Bight the area of greatest density of eggs per m² did not remain in the same position, but moved about fifty miles in a general north-westerly direction during the period from 23 January to 12 April. At no time were large numbers of plaice eggs found, the highest number of group I eggs per m² being eight, compared with sixty-five per m² in the Southern Bight in the previous year, January 1948.

The depth of water in the area varied from about fifteen fathoms in the south to forty fathoms in the north, with the higher concentrations of eggs occurring in water of twenty-five to thirty-five fathoms. A few eggs were also found on the north-western edge of the Dogger Bank on the survey of 19–26 February (Fig. 24).

From the curve of daily egg production (Fig. 20) it is seen that spawning started in mid-January and ended towards the end of April. Compared with the Southern Bight the spawning in this area was of low intensity, of slightly longer duration (about fourteen weeks compared with twelve to thirteen weeks) and several weeks later.

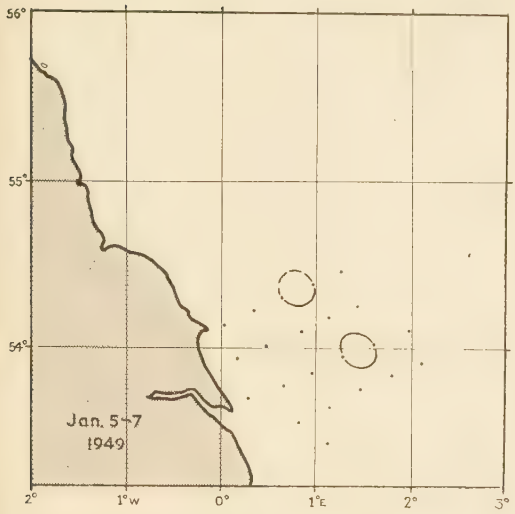


Fig. 21

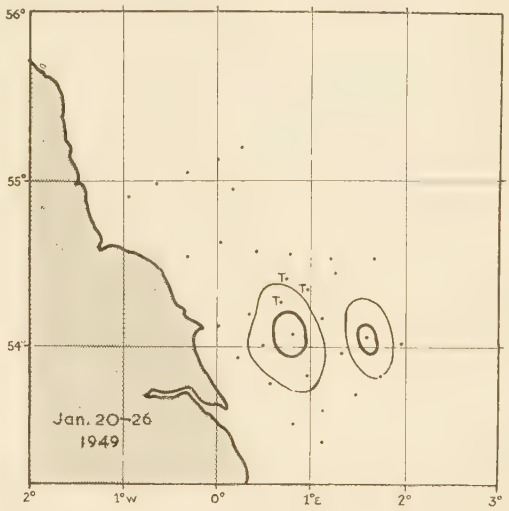


Fig. 22

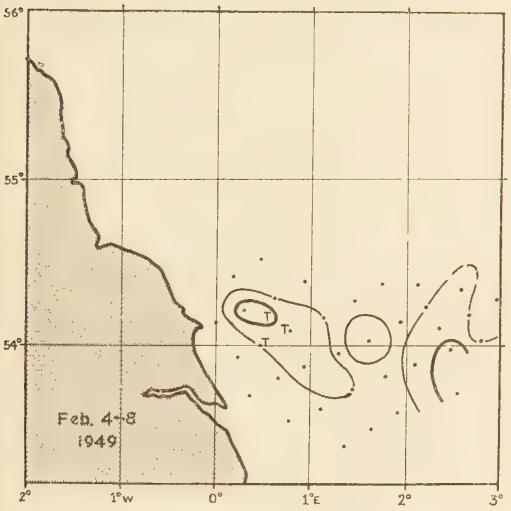


Fig. 23

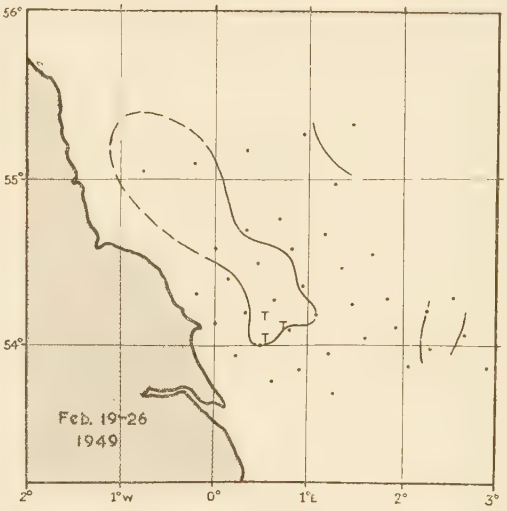


Fig. 24

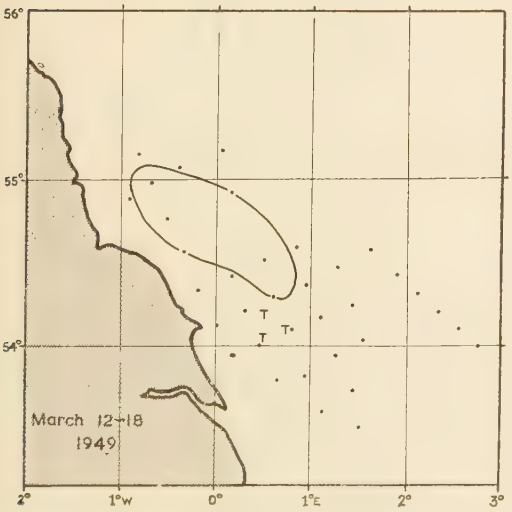


Fig. 25

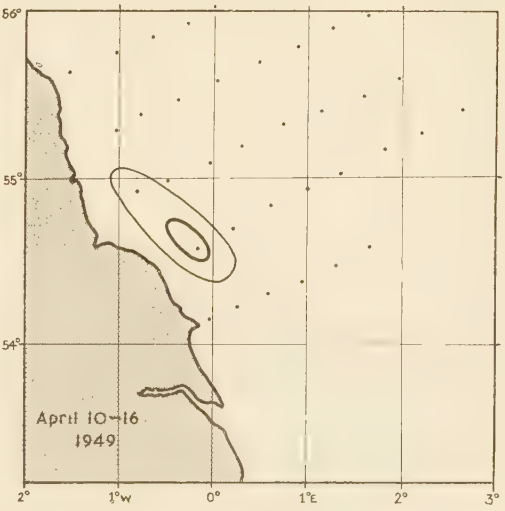


Fig. 26

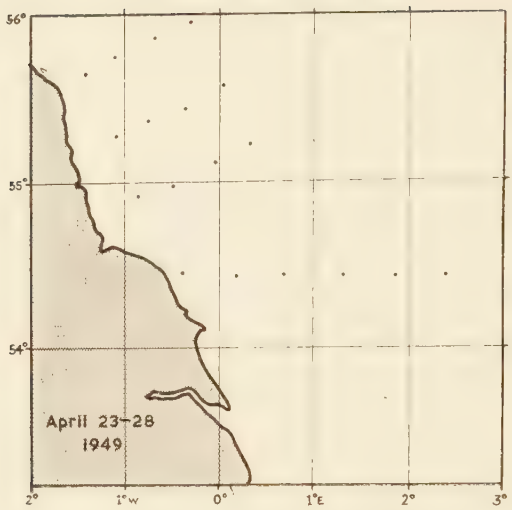


Fig. 27

Figs. 21–27. *The distribution of group I plaice eggs off the north-east coast of England in* 1949. *Contours are shown at* 1 *and* 5 *group I eggs below* 1m^2. *Trawling stations are indicated by the letter T.*

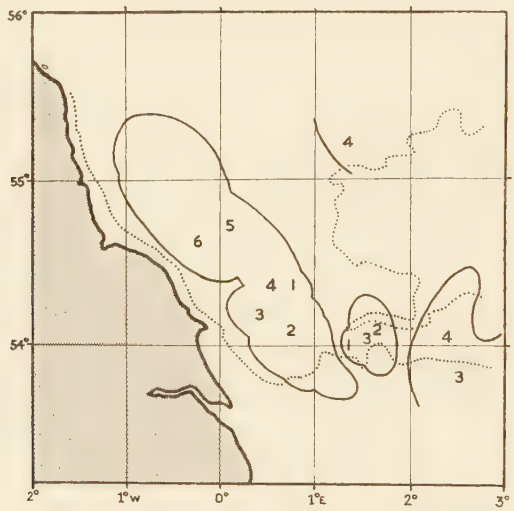


Fig. 28. *Composite chart showing the limit of the* 1 *contour in the six surveys and the positions of the maximum egg production on each survey* (*numbers* 1–6).

C. THE BORKUM AREA

As with the Flamborough area, there has long been evidence of spawning by the plaice in the area south-east of the Dogger (Masterman, 1911, p. 15). The evidence from the distribution of eggs consists of miscellaneous plankton hauls summarized by Ehrenbaum (1910), a series of fish egg surveys carried out by German workers between 1926 and 1953, which have been described by Aurich (1941), Bückmann (1953) and Bohl (1954), and a single survey by the present author in 1948.

The later quantitative German work, while being quite extensive, included only one survey in each year and only one of these (in 1936) was made in February, the month when

most spawning might have been expected to occur in this area. The surveys between 1926 and 1937 reported by Aurich were made with the Hensen net and the Helgoland larva net, and the eggs were analysed for their stages of development, the first stage being described in general terms as 'Embryo not yet recognizable'. Unfortunately no figure is given, but this stage must correspond closely with our stage I, though it may include slightly older eggs. By taking this stage I as comparable with our group I these data may be directly compared with ours, with the proviso that it may give slightly too high figures. Aurich's stage I data for the 1936 and 1937 surveys and that of Bohl for 1953 have been replotted in a form directly comparable with the rest of the charts in this paper, as Figs. 30–32.

In the absence of any series of surveys in one year by which to determine the duration of spawning and the time of maximum egg production, the existing information will be described in the order of the dates on which the surveys were made, irrespective of the year. This may lead to some uncertainty of interpretation, due to different conditions in different years, but should yield as much information as the data can reliably give.

The 16–17 January 1948 survey (Fig. 29) consisted of two east-west lines of stations across the area north of Borkum, the southern line running at 54°17′N along the northern

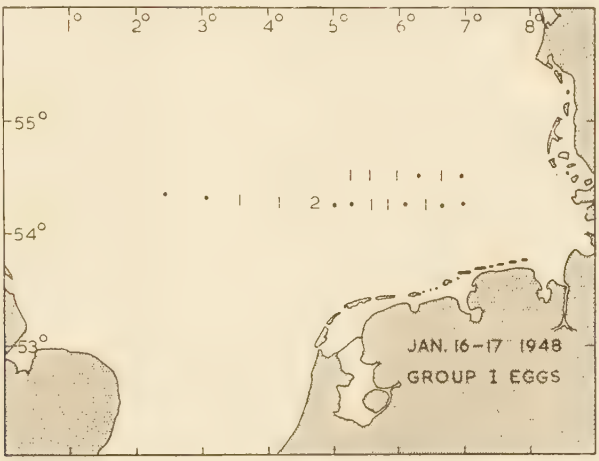


Fig. 29. *Distribution of group I plaice eggs in the Borkum area on* 16 *and* 17 *January,* 1948. *Numbers of eggs below* 1*m*².

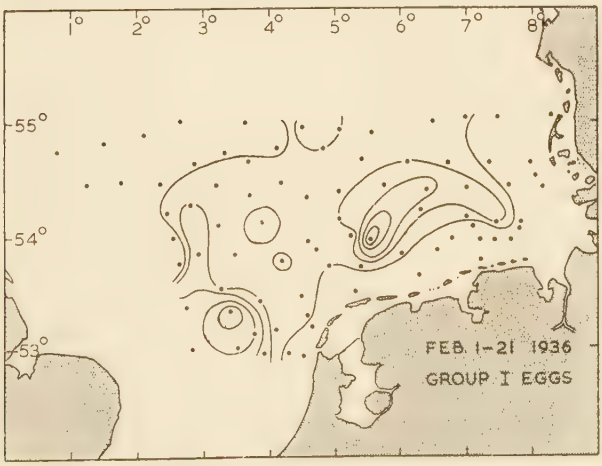


Fig. 30. *Distribution of group I plaice eggs between* 1 *and* 21 *February,* 1936 (*from Aurich,* 1941, *Fig.* 10).
Contours are shown at 1, 5, 15, 25, 35, *group I eggs below* 1*m*².

edge of a remaining minefield, and therefore as near to the area described by Aurich as was possible. This survey showed the presence of a very small number of group I eggs, indicating that the spawning here had scarcely started.

Fig. 30 shows the distribution of Aurich's stage I eggs of 1–21 February, 1936, and shows the presence of two areas of young eggs, one off Texel, the other north of Borkum, in both of which the concentration of eggs in which the embryo is not yet recognizable reached over 35/m². The Borkum area of spawning is seen to be well defined, centred at about 54°N and 5°40′E and extending in an eastward direction nearly as far as Helgoland. A smaller, less intensive area was also located by these stations on 55°N, a little east of the Dogger. At the three stations in the Borkum area within the 15/m² contour the group I plaice eggs were only 15%, 12% and 21% of all plaice eggs. As plaice eggs spend 21% of their time as group I eggs these percentages indicate that spawning was well in progress and in 1936 would have passed peak egg production by the middle of February.

Bückmann's observations in late February 1952 in the Borkum area include a single line of stations from approximately east to west in the Borkum area. They show the existence of spawning in the same general area in late February. Out of 170 plaice eggs per m² at his station 3 (54°10′N, 6°45′E, on 26 February) approximately 24 or 14% were of group I, indicating that spawning was well advanced by this time in 1952.

The distribution of stage I eggs of the survey of 1–19 March 1937 is shown in Fig. 31, and, with the fact that most of the eggs on this survey were older eggs (see Aurich, Fig. 12), it is clear that spawning had nearly finished and that the spawning in March 1937 was further east than in February 1936.

Bohl's survey of 3–14 March 1953, like those of 1948 and 1952, was still hampered by the continued existence of minefields south of 54°10′N. The distribution of group I eggs, which is shown in Fig. 32, closely resembles that which Aurich found in 1–21 February 1936, just a month earlier. The general area covered and density of eggs of the two surveys are very similar except for the single station with 40 group I eggs somewhat to the east of the main concentration in 1953. Although the low temperatures in the area of spawning in March 1953 (4·5°C) compared with February 1936 (6·1°C) will have inflated the 1953 figures, by slowing the rate of development of the eggs, this alone cannot have caused the considerably greater catches of plaice eggs in March 1936. The numbers of group I eggs, as percentages of all the plaice eggs caught at each of the three stations within the main 15/m² contour, were 8%, 23% and 18%; at station 76, to the eastward, the figure was 28%.

From these surveys there can be no doubt that there is a regular and considerable spawning in the Borkum area, probably starting in mid-January and normally ending in

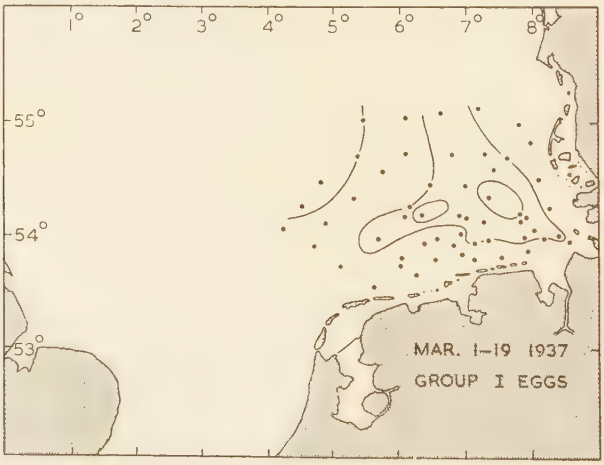


Fig. 31. *Distribution of group I plaice eggs between* 1 *and* 19 *March*, 1937 (*from Aurich*, 1941, *Fig.* 12).
Contours are shown at 1 *and* 5 *group I eggs below* 1*m*².

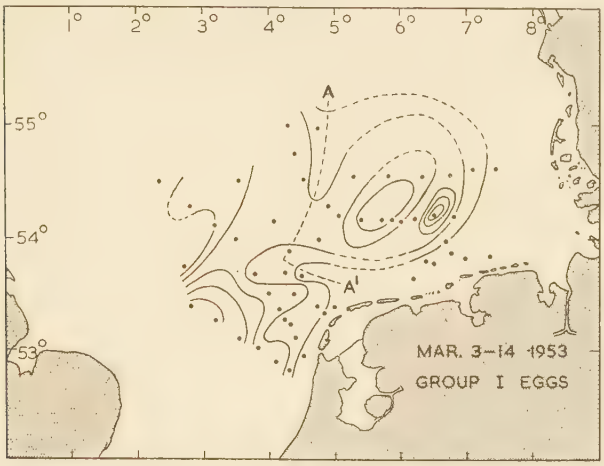


Fig. 32. *Distribution of group I plaice eggs between* 3 *and* 14 *March*, 1953. (*from Bohl*, 1954, *Fig.* 16, *supplemented by data from H. Bohl*). *For explanation of A and A' see p.* 35.

mid or late March, with a maximum in February. The 1953 data suggest a somewhat later spawning, but, as pointed out by Bohl, and in conformity with the experience in 1947 (Simpson, 1953), the cold conditions in 1953 were probably largely responsible for this lateness. Both Aurich and Bohl seem surprised that this spawning area has proved to be so rich, and have tried to find reasons why the spawning might have been unusually great in the years in which their work was done. However it seems most likely that the absence of systematic surveys in these areas in January or February has been responsible for the Borkum spawning having been underestimated in the past.

The relative importance of this area compared with the other North Sea spawning areas is discussed in sections IVD and VI.

Fig. 33 has been drawn to obtain an estimate of annual egg production for the area.

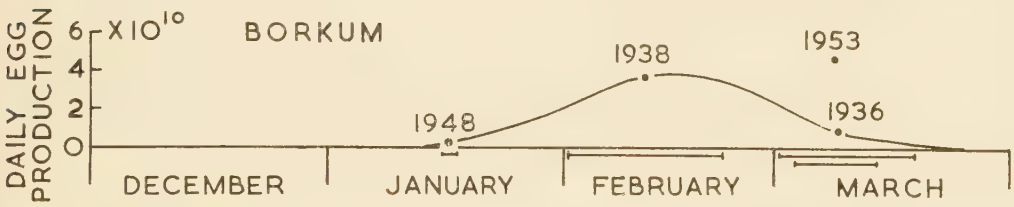


Fig. 33. *Estimated curve of daily egg production for the Borkum spawning area. The durations of the surveys referred to in the text are shown by the lines below the base line.*

D. THE EAST COAST OF SCOTLAND

For completeness a note is here given on Bowman's work on the plaice spawning to the east of Scotland (Bowman, 1914, 1921). During the winters of 1905 to 1912 many plankton hauls were made along the east coast of Scotland from the Shetland Isles (61°N) to the Firth of Forth (56°N), and the catches of plaice eggs were used by Bowman to study the spawning in this area. Both vertical and horizontal hauls were made with 1 m cheese cloth conical nets at most stations, but as very few eggs were caught in the vertical hauls Bowman used primarily the catches from the half-hour surface hauls for the location of the spawning areas.

Bowman found that plaice eggs in early stages of development occurred in small numbers

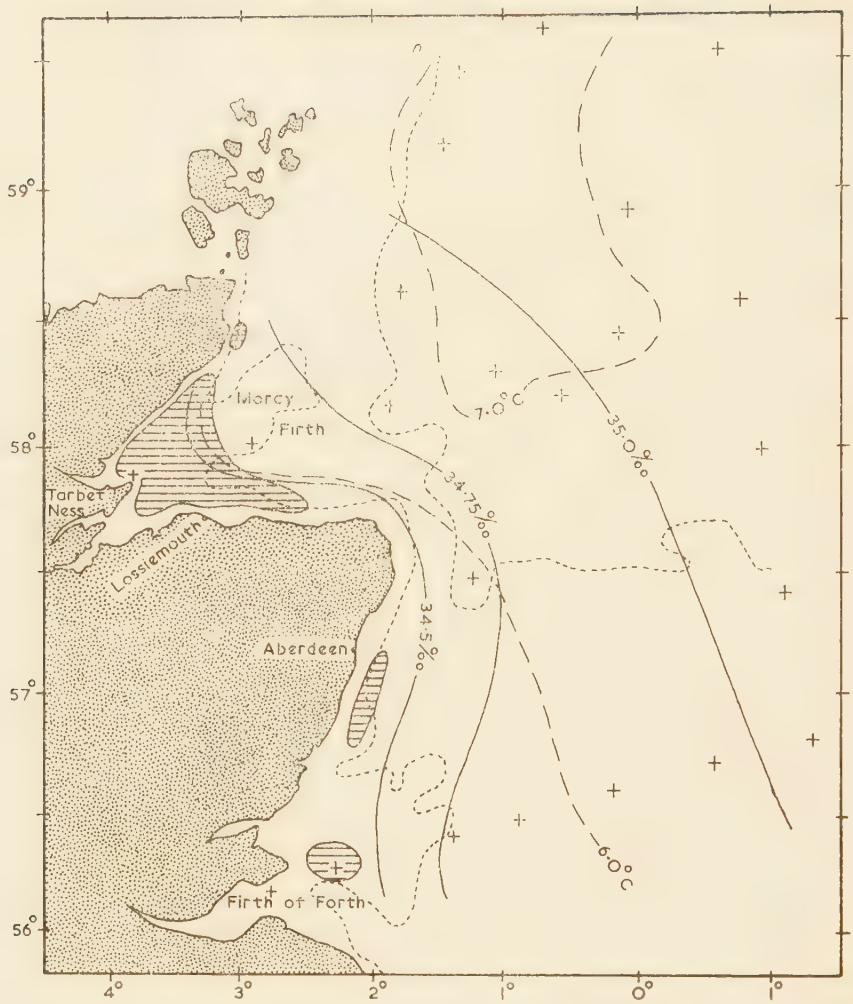


Fig. 34. *The main areas (hatched) off the north-east coast of Scotland where plaice eggs were found by Bowman, and the distribution of temperature and salinity in* 3–24 *February*, 1909. *The crosses mark the positions of the hydrographic stations on the basis of which the isotherms and isohalines have been drawn.*

over a wide area off the east coast of Scotland in water of less than 50 fm but that catches of over 10 young eggs per half-hour haul occurred only in three areas, the Moray Firth, about 20 miles south of Aberdeen off Tod Head, and off Fife Ness near the mouth of the Firth of Forth. These positions are shown in Fig. 34. By far the most important of these areas for spawning was the Moray Firth and here the largest catches of young eggs occurred just north of Tarbet Ness and off Lossiemouth. These areas were in depths of from 10 fm to a little over 30 fm and from 2–30 miles from the shore.

While the largest catches of young plaice eggs reached 1,300 per half-hour haul, Bowman stresses that only 3 of all the vertical hauls gave more than 10 eggs of all stages of development and the maximum was 17 (Bowman, 1914, p. 11) compared with many vertical hauls made by Dutch and German workers at the same time in the southern North Sea in which catches exceeded several hundred.

With regard to the time of spawning, it is not easy to establish this clearly. Bowman writes (1921, p. 11) 'On the Scottish North Sea coast spawning usually begins in the winter months and continues throughout the spring, while a small number of individuals may extend the spawning period into the early summer.' After pointing out that the Moray

Fig. 35. *The spawning areas and times of peak spawning of the plaice in the North Sea.*

Firth area is probably the earliest area as well as the most important, and that here eggs have been found in November, he continues 'As the season advances spawning becomes more and more general until in the month of February plaice have begun to spawn at practically all spawning localities in the northern North Sea.' From the data presented it appears that peak spawning probably occurs in late February or March, but as few observations were made after March it is not possible to say how long spawning of any importance continues in these areas. It is interesting to note that within the Moray Firth area the spawning appears to move progressively off shore, eastwards. It appears that spawning in parts of this area is only completed during May or even later.

In Fig. 35 an attempt has been made to summarise the findings on the limits of the plaice spawning areas of the North Sea. Owing to the fact that the spawning is not occurring

at the same time all over the area, the chart has been drawn to show the highest concentrations of group I eggs that might be expected in each area during the spawning season as a whole. The contour values would correspond with a spawning population of medium size—less than that found in 1921 or 1947 and 1948, but more than the low values of 1935 and 1936.

As the catches in Scottish waters were made with nets which are not directly comparable with the Hensen net data the markings on Fig. 35 referring to the Scottish area can be taken as only approximately correct quantitatively, though the positions will be close to the truth.

E. SOME CHARACTERISTICS OF THE SPAWNING AREAS

In most of the past reports on the spawning areas of the plaice in the southern part of the North Sea it has been pointed out, or even stressed, that there is a close similarity between the limits of the spawning areas and the distribution of the temperature and salinity of the water. (Redeke and van Breemen, 1909; Ehrenbaum and Mielck, 1910; Buchanan-Wollaston, 1914, 1926, and Bohl, 1954). Some of these authors have suggested that there may be a causal relationship, the plaice seeking out for spawning the more saline and warmer water.

The present review shows also that in the southern North Sea the main spawning does largely occur in the tongue of more saline and warm water entering the Southern Bight from the English Channel. However, an examination of the positions of the Flamborough and Moray Firth spawning areas in relation to the temperature and salinity (Fig. 36) shows

Fig. 36. *The main centres of spawning (shaded) and the mean isotherms and isohalines for February* 1902–1928. (*From Atlas de temperature et salinité de l'eau de surface de la mer et de la Manche*, 1933).

that these spawning areas are in water which is of the same or lower temperature and salinity than the more off-shore areas where the adult plaice feed in summer.

It would therefore appear that temperature and salinity are not in themselves factors of importance in determining where plaice will spawn.

It is also seen that the North Sea spawning areas are in places where there is no common depth factor. The Moray Firth spawning occurs in water that ranges between 10 and 40 fm, the Flamborough area ranges between 15 and 40 fm, the Borkum area between 12 and 22 fm, and the Southern Bight area between 12 and 25 fm. That this is not the full range is seen from the fact that young plaice eggs and spawning plaice were found in about 8 fathoms of water 5 miles from the beach in Cardigan Bay on the Welsh coast (Simpson, in press), and Milinski (1938) reports that plaice spawn in 100 fathoms of water off the Murmansk coast.

When seen in the content of the whole distribution of the plaice in the North Sea, i.e., from the Dutch coast northwards to about the 60 fathom contour in or about 58°N the spawning areas are all coastwards—if not actually coastal. This also applies to the Irish Sea and Murmansk spawning areas.

It would seem therefore that in addition to, or as a part of any spawning migration which is related to water movements (Garstang, 1909; Borley, 1916; Meek, 1916; Russell, 1937) a movement towards the coast also takes place.

Although the Southern Bight spawning area lies away from either the English or continental coasts, the Southern Bight is in fact a bay when considered as part of the North Sea as a whole, or considered historically.

IV. ANNUAL EGG PRODUCTION

A. THE SOUTHERN BIGHT

When Buchanan-Wollaston first outlined in 1914 the objects of his plaice egg surveys he included as a main aim the determination of the total number of eggs laid each year (Buchanan-Wollaston, 1914, p. 1).

In his later reports Buchanan-Wollaston gave figures for egg production for 1911, 1914 and 1921 in the form of an 'Index of Egg Production', since the surveys had not covered the whole of the spawning period and he was, therefore, unable to obtain absolute values. As has been described, it has now been possible to use the results of the surveys to draw curves of daily egg production for ten years, the information on the duration of spawning in later years being used to complete the otherwise incomplete curves of 1914 and 1921. The area enclosed by the curve of daily egg production gives the total egg production for the year. In this way it has been possible to obtain eight estimates of annual egg production based on two or more surveys. In addition, the single surveys of 1935 and 1937 were made sufficiently close to the peak period of spawning to permit a 'most likely' curve of annual egg production to be drawn, thus giving a rough estimate of the egg production in these two years.

The estimates of annual egg production for the ten years are shown in table 3.

Since the number of eggs laid by a female plaice is directly proportional to its weight, the total egg production of the stock is directly proportional to the weight of the females taking part in the spawning.

Information is available on the weight of plaice in the spawning area each year from the commercial statistics (in the form of the catches per 100 hours' fishing by months in each statistical rectangle) and these figures can therefore be used to estimate the egg production in those years in which no plaice egg surveys were made. For this purpose the mean catch per hundred hours' fishing in rectangles G2 and G3 (Fig. 39) in January and February have been extracted for the years 1913 to 1956, and these are given in table 4.

Table 3: *Total annual egg production in the Southern Bight*

Year	*Annual egg production*
1914	$3{\cdot}36 \times 10^{12}$
1921	$7{\cdot}60 \times 10^{12}$
(1935	$(2{\cdot}88 \times 10^{12})$
1936	$1{\cdot}73 \times 10^{12}$
(1937	$(1{\cdot}94 \times 10^{12})$
1938	$3{\cdot}07 \times 10^{12}$
1939	$2{\cdot}18 \times 10^{12}$
1947	$4{\cdot}21 \times 10^{12}$
1948	$3{\cdot}66 \times 10^{12}$
1950	$1{\cdot}96 \times 10^{12}$

While these figures can be used as an index of the spawning stock they are subject to certain sources of error which must not be overlooked during their use.

(a) While the plaice landed from the spawning area are of both sexes, our relationship depends only on the weight of female fish.

(b) Like all commercial fishery statistics they are influenced to a certain extent by weather.

(c) The relationship between catch per hundred hours' fishing and the egg production changes if the efficiency of the fleet changes. This is the most important error if the relationship is to be used over many years during which improvements in gear are made. It is therefore necessary to check the relationship from time to time by new egg surveys carried out with standard equipment.

In fig. 37 these catches per 100 hours' fishing for each year (table 4), are plotted against the corresponding annual egg production figures.

Since considerable improvements in fishing efficiency took place between 1921 and 1935, it is necessary to separate the data into those obtained before and after this period. With the exception of that for 1938 the points fall into two groups on this basis. The 1938 curve of egg production (Fig. 18) stands out among those based on three or more surveys, in that the mid-January figure of 780×10^6 eggs per day is higher than would be expected on the

Table 4: *Catch of plaice, in cwt, per* 100 *hours' fishing, by* 1*st class steam trawlers, in the spawning area.* (*Total catch in rectangles G2 and G3 in January and February, divided by the corresponding number of hours' fishing*)

Year	*Catch per* 100 *hours*	*Year*	*Catch per* 100 *hours*	*Year*	*Catch per* 100 *hours*
	cwt		*cwt*		*cwt*
1913	20·5	1930	30·6	1946	125·9
		1931	20·9	1947	64·7
1920	54·2	1932	22·1	1948	60·1
1921	44·0	1933	24·6	1949	53·3
1922	43·2	1934	30·6	1950	40·2
1923	22·8	1935	20·4	1951	43·3
1924	33·2	1936	26·7	1952	47·1
1925	29·5	1937	27·5	1953	65·1
1926	26·6	1938	27·6	1954	54·5
1927	33·3	1939	33·3	1955	59·6
1928	28·8			1956	56·3
1929	34·2				

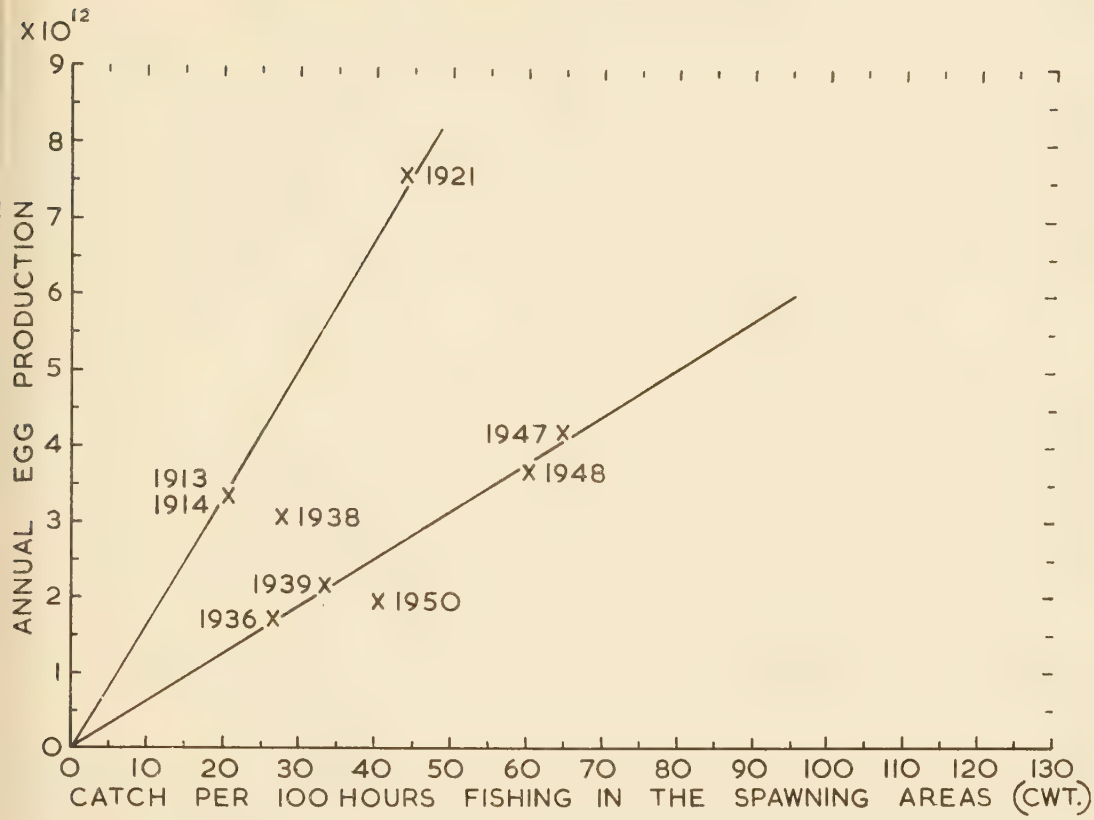


Fig. 37. *Relation between total annual egg production in the Southern Bight and the density of plaice in the spawning area, as given by the catch per hundred hours' fishing in rectangles G2 and G3 in January and February for different years* (*Table* 4).

basis of the other figures of daily egg production in 1938. Further examination of the data showed that the high value of daily egg production for the survey of 22–27 January, 1938 was the result of high catches at only three stations, at each of which only one haul of the Hensen net was made. This could have contributed to this high figure but cannot have been the whole cause.

Excluding the 1938 figure, the data for 1936 to 1950 give a relationship which allows the commercial statistics to be used for estimating the corresponding egg production in years when egg surveys were not made.

Data for catch per hundred hours' fishing and egg production for 1921 is available, but prior to 1920, 1913 is the only year for which the catch per hundred hours' fishing is available.

As the size of the fishing fleet was in a fairly steady state in the period prior to the 1914–18 war, the density of plaice in the spawning area is not likely to have changed greatly between 1913 and 1914. When the 1914 egg production is plotted with the 1913 catch of plaice, it is found that the point so produced falls approximately on the line joining the 1921 point with the origin.

As precisely the same gear and methods were used for estimating the egg production in the years before and after the 1922–1934 gap, the difference in slope of the two lines in Fig. 37 must be due to the increased efficiency in the fishing boats in the interval. This increased efficiency can be estimated by reference to any one arbitrary density of spawning fish, for example, that which produces 4×10^{12} eggs. The corresponding catch in the 1914/1921 period was 23·5 cwt per 100 hours' fishing, compared with 63·5 cwt in the 1936/1950 period, indicating an increase in efficiency by a factor of 2·7.

The relationships shown in Fig. 37 are of particular value in assessing the approximate maximum egg production reached in the two periods of reduced fishing, due to the two

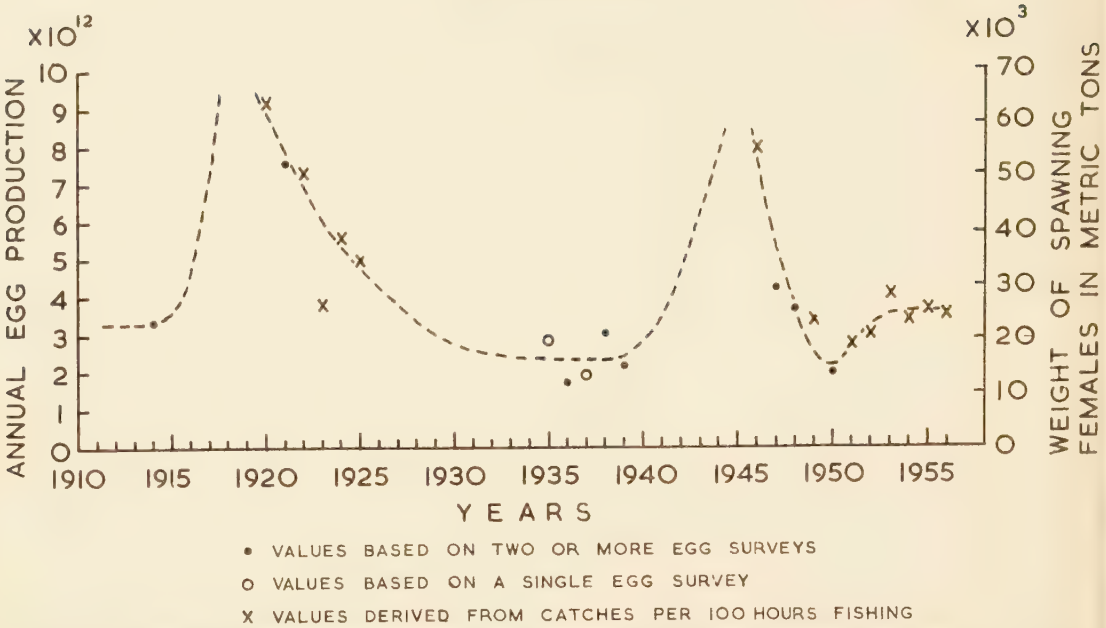


Fig. 38. *Annual plaice egg production in the southern North Sea, between the Straits of Dover and* 53°*N, in the years* 1914 *to* 1956, *derived from plaice egg surveys and the density of fish in the spawning area.*

wars, when the stock of plaice reached a density considerably above that of the peace time periods. The values of annual egg production from the egg surveys (table 3) with those derived from the catch per hundred hours' fishing are shown in Fig. 38 for much of the period 1914 to 1955.

It may be seen that the egg production during the periods of increased stock probably reached values above 9×10^{12} at the end of the 1914–18 war[1] and above 8×10^{12} by the end of the last war, while during the period of heavy fishing in the late 1930s the egg production was only a little over 2×10^{12}. While the catch per 100 hours' (table 4), and therefore presumably the egg production, fell very rapidly between 1946 and 1950, the weight of mature females became stabilised after 1950 at a level of about 25×10^3 metric tons, corresponding to an egg production of about $3{\cdot}5 \times 10^{12}$, some 50% above the pre-war level.

B. THE EASTERN ENGLISH CHANNEL

Only in three years, 1936, 1938 and 1947, have observations been made that allow an estimation to be made of egg production in the eastern English Channel, and the figures for 1936 and 1938 are rendered uncertain owing to the observations not being extended sufficiently far west to allow the contours to be closed with certainty.

In 1936 all five surveys extended as far west as the line between Beachy Head and Boulogne, but on the last two surveys no young eggs were found west of the Straits of Dover, and it is pretty certain that spawning had ceased there by the end of January. The curve of egg production is shown in Fig. 18 from which was derived an annual egg production of $0{\cdot}18 \times 10^{12}$ eggs.

The 1938 surveys extended again as far as the Beachy Head–Boulogne line and again indicated that spawning was virtually complete by the end of January. Maximum spawning in this area must have occurred at the very end of December, about mid-way between the dates of the first two surveys of the season. From the curve of daily egg production an

[1]Borley (1923) and Borley and Thursby-Pelham (1925) found that the catch of plaice per 100 hours' fishing in all areas of the North Sea decreased during the years 1919, 1920 and 1921, suggesting that the stock, and therefore egg production, was at its maximum in 1918 or 1919.

annual egg production of $0{\cdot}15 \times 10^{12}$ was obtained. This figure was slightly less than that for the same area in 1936 and is therefore corroborative evidence that the figure for annual egg production in the Southern Bight in 1938 is too high, as suggested earlier.

The three 1946/47 surveys that made a full coverage of the eastern English Channel area show that in this year spawning almost certainly was well advanced by mid-December, and continued into February. The ends of the curve of annual egg production cannot be drawn with certainty, but as they stand give a production in 1946/47 of $0{\cdot}62 \times 10^{12}$ eggs which indicates a very much greater spawning in this area than in the pre-war years. The significance of this is discussed in section VI.

C. THE FLAMBOROUGH AREA

The six plaice egg surveys in 1949 gave six points on the daily egg production curve for that year (Fig. 19), and the area below this curve gives an annual egg production of $0{\cdot}39 \times 10^{12}$. Unfortunately we do not have a direct estimate for plaice egg production in the Southern Bight in the same year with which this value can be compared. However, the 1948 Southern Bight production was $3{\cdot}66 \times 10^{12}$ and from the catch per hundred hours the 1949 egg production was probably about $3{\cdot}35 \times 10^{12}$; thus the number of eggs produced in the Flamborough area was about $\frac{1}{9}$th of that produced in the Southern Bight in the same year.

D. THE BORKUM AREA

Aurich's and Bohl's data may be used to obtain rough estimates of the egg production in this area. There is some uncertainty in the exact definition of Aurich's stage I eggs, but it is probably close to Buchanan-Wollaston's group I and may be used for obtaining an approximate estimate. Unfortunately Aurich also does not tabulate his data and therefore the number of eggs at each station has had to be determined from the histograms of his chart 10, with the possible introduction of further small errors. Bohl has kindly supplied me with his original figures for which the analysis of egg stages has been based on Apstein's stages, with the result that they are directly comparable with the group I eggs used in this paper for the Southern Bight. The calculations from these data are therefore more strictly comparable to the Southern Bight figures, although no adjustment for the depth of the water and the haul, nor for off-vertical hauls, has been possible.

From Aurich's data and using the methods already described in section II, a figure of $3{\cdot}7 \times 10^{10}$ has been obtained for daily egg production in the Borkum spawning area at the time of the survey of 1–21 February 1936. The area has been limited in the west by a line from 55°0′N, 4°0′E to 53°30′N, 5°0′E and a mean temperature of 5·5°C has been used.

The comparable figure for Bohl's survey of 3 to 14 March, 1953, is $4{\cdot}85 \times 10^{10}$ eggs laid per day. In this case the limit of the area was made closely comparable to the 1936 observations by using the trough in egg numbers between the main Borkum area and the spawning in the Botney Gut area, marked AA′ in Fig. 32. A mean temperature of 4·5°C has been used.

The value of these figures for the estimation of annual egg production in the Borkum area is limited by the absence of other surveys in these years, which makes the drawing of the curves of annual egg production very uncertain. However, assuming a ten week spawning period for the Borkum area and peak spawnings of $3{\cdot}75 \times 10^{10}$ eggs per day and $4{\cdot}85 \times 10^{10}$ eggs per day, and daily egg production curves of the same shape as those for the Southern Bight in 1936 or 1950, estimates of annual egg production of $1{\cdot}3 \times 10^{12}$ and $1{\cdot}8 \times 10^{12}$ respectively are obtained. As Aurich's and Bohl's surveys were probably somewhat after peak spawning these estimates of annual egg production are almost certainly underestimates for these years.

The significance of these figures is discussed in section VI when dealing with the relative importance of the North Sea spawning areas.

V. THE WEIGHT, NUMBERS, AND AGE COMPOSITION OF THE SPAWNING PLAICE

In this section the annual egg production is used as a starting point for estimating the weight and numbers of female plaice participating in the spawning. By using in addition age composition data, the total numbers of spawning females have been split up to give the number of each age group present.

A. THE WEIGHT OF THE SPAWNING STOCK

The relation between number of eggs laid and the weight of the females that laid them is, for the southern North Sea, approximately $F = 142{\cdot}93W$, and for the Flamborough area approximately $F = 169{\cdot}33W$, where F = number of eggs and W the gutted weight of the fish in grams[1] (Simpson, 1951).

Using these relationships and the annual egg production figures for 1947, 1948, 1949 and 1950 (table 3) we obtain the following weights of spawning females.

Table 5: *Weight of spawning females in metric tons*

Year	*Southern Bight*	*Flamborough*
1947	$29{\cdot}5 \times 10^3$	
1948	$25{\cdot}6 \times 10^3$	
1949	$(23{\cdot}4 \times 10^3)$*	$2{\cdot}36 \times 10^3$
1950	$13{\cdot}7 \times 10^3$	

*Based on the estimated egg production value of $3{\cdot}35 \times 10^{12}$.

Basing the calculation on the figures of 1950 as being typical of the low level of the stock of the North Sea may be made for that year.

Basing the calculation on the figures of 1950 as being typical of the low level of the stock during periods of heavy exploitation, we start with 14 million kilos of spawning females in the Southern Bight. As the egg production in the Southern Bight is probably about 53% of the total for the North Sea during heavy exploitation (see discussion on the relative importance of the spawning areas, Section VI), we obtain a total weight of spawning females of $\frac{14 \times 100}{53}$ or 26 thousand tons. Assuming that the weight of mature males is approximately equal to that of females, there is obtained a final figure of 52 thousand tons for the mature stock of the North Sea.

B. THE NUMBERS OF SPAWNING PLAICE

Buchanan-Wollaston (1923, p. 8) estimated the number of female plaice spawning in the southern North Sea in 1914 to be about 17,375,000. As already explained he was not at that time able to obtain a curve of daily egg production for the whole year and therefore he used the level of egg production on his two 1914 plaice egg surveys to give an estimate

[1]This expression is derived from the number of eggs present in the ovaries and therefore includes both the number of eggs which remain in the ovary and are resorbed and also those eggs that fail to be fertilised. However the author believes that both of these values are extremely small and that they would give a total positive error of less than 1% in estimating the weight of the fish from the number of eggs that are fertilised in the sea. The negative error due to using group I eggs for estimating the total number of eggs laid, thus ignoring those that are lost by predation, etc., is probably rather greater than the above positive error.

of the monthly egg production ($1{\cdot}7375 \times 10^{12}$). This figure he divided by 200,000, 'the average number of eggs annually produced by a female plaice', to give an estimate of 8,687,000 for the total monthly Fish Stock. This figure Buchanan-Wollaston doubled, giving 17,375 million female fish as 'the total number of fish taking part in spawning throughout the season'. Buchanan-Wollaston fully appreciated that a good deal more quantitative data was necessary for an accurate value to be obtained.

The data now available makes this more accurate estimate possible. When deriving the number of spawning females from the annual egg production, Buchanan-Wollaston used a figure for mean fecundity which he considered would apply in all years. However, the mean fecundity alters considerably from year to year if the size composition of the spawning females is changing. For instance, during the three years 1947, 1948 and 1949 the mean fecundity of plaice spawning in the Southern Bight was found to have fallen by 40% (see table 6). Further, the mean fecundity in the Flamborough area was found in 1949 to be more than twice that holding for the Southern Bight in the same year.

Table 6: *Mean fecundity of the plaice* (*from Simpson*, 1951)

Year	*Southern Bight*	*Flamborough*
1947	105,900	
1948	85,900	
1949	63,800	140,400
1950	70,000*	

*This figure has been obtained since the values for 1947–1949 were published. It was derived in the same way as the earlier figures (Simpson, 1951, p. 13) using % length data from research ship sampling (see this paper, Fig. 40).

The number of females spawning each year has been obtained by dividing the annual egg production (table 3) by the figures for the mean fecundity for the same year (table 6). The results of these calculations are shown in table 7.

Table 7: *Numbers of spawning females*

Year	*Southern Bight*	*Flamborough*
1947	39·8 million	
1948	42·6 ,,	
1949	(52·5 ,,)*	2·85 million
1950	28·0 ,,	

*Based on the estimated egg production of $3{\cdot}35 \times 10^{12}$.

Thus the rapid change in the size composition of the spawning stock, which is described in the next section, resulted in quite a different sequence of events when the weights of spawners during these years are compared with the numbers of spawners. While the total weight of spawners steadily fell, the numbers of spawning females increased from 1947 to 1949, to be followed by a major decrease in 1950.

C. AGE COMPOSITION

Having been able to obtain an estimate of the total number of females taking part in the Southern Bight spawning it was a logical step to use this estimate to determine the numbers

of each age group taking part in the spawning. In addition to aiding the understanding of those changes in weight and numbers of spawners that have been described in the preceding section, such age composition data might be expected to provide, in absolute figures, data from which the age of recruitment to the mature stock could be obtained.

However the obtaining of reliable data on the age composition of the mature females in the spawning area presented considerable difficulties which have only partly been overcome. The use of commercial landings for obtaining age data were unsuitable after 1947 when an increased minimum size limit* excluded significant numbers of the youngest mature fish from the market, and therefore research ship samples had to be obtained. Research ship samples were obtained in 1948, 1949 and 1950, but for various reasons, as explained below, exactly comparable sampling was not carried out each year.

In 1948 the 90 ft research ship PLATESSA was used for sampling the spawning stock at the same time that the 120 ft research ship SIR LANCELOT was being used for the egg surveys. Six trawling positions (Fig. 39) were chosen near the centre of the spawning area and it was

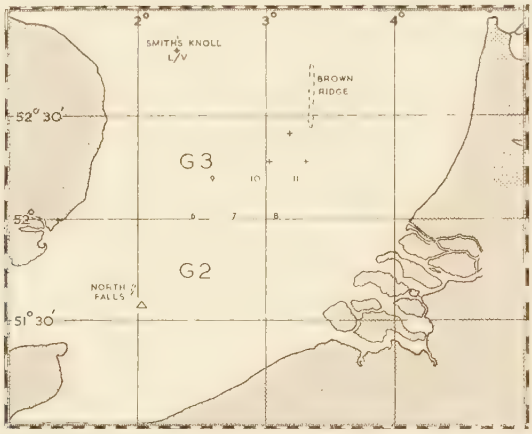


Fig. 39. *Various areas and positions referred to in the text.*

Nos. 6–11 — *positions fished by M.V.* PLATESSA, 1947/48.
+ — *positions fished by S.T.* SIR LANCELOT, 1948/49 *and* 1950.
△ — *position fished by S.T.* SIR LANCELOT, *in* 1950.

planned that two 3-hour hauls should be made at each position at approximately two weekly intervals throughout the spawning period. Weather interfered with the programme and only part of the plan was realised. Although all stations were not worked 3,799 mature plaice were caught, and in addition to recording length and sex, the otoliths were removed and the ages determined. As is typical of a plaice spawning area only a small proportion of the mature plaice, 435 out of the 3,799, were females. The full results are shown in Appendix II, table I, and the age composition for the spawning females was obtained by summing all the material obtained.

In 1949 the PLATESSA was not available. The plaice egg surveys in this year were being carried out by the SIR LANCELOT in the Flamborough area and it was decided to use this ship to sample the spawning fish in this area as well as for continuing the sampling of the fish in the Southern Bight. In the Flamborough area trawling was started on the second survey at a triangle of three stations 10 miles apart, in the area where the few plaice eggs had been found on the first survey. In the light of the egg distribution on the second and third surveys the trawling positions were moved about 15 miles S.S.E. for the third, fourth and fifth surveys (see Figs. 23–25).

The trawl sampling in the Flamborough area thus covered 25 January to 19 March which was the main spawning period, but while the trawling on the second, third and fourth plaice egg surveys was carried out in or close to the area where group I eggs were

*The legal size was increased from 9 to 10 inches.

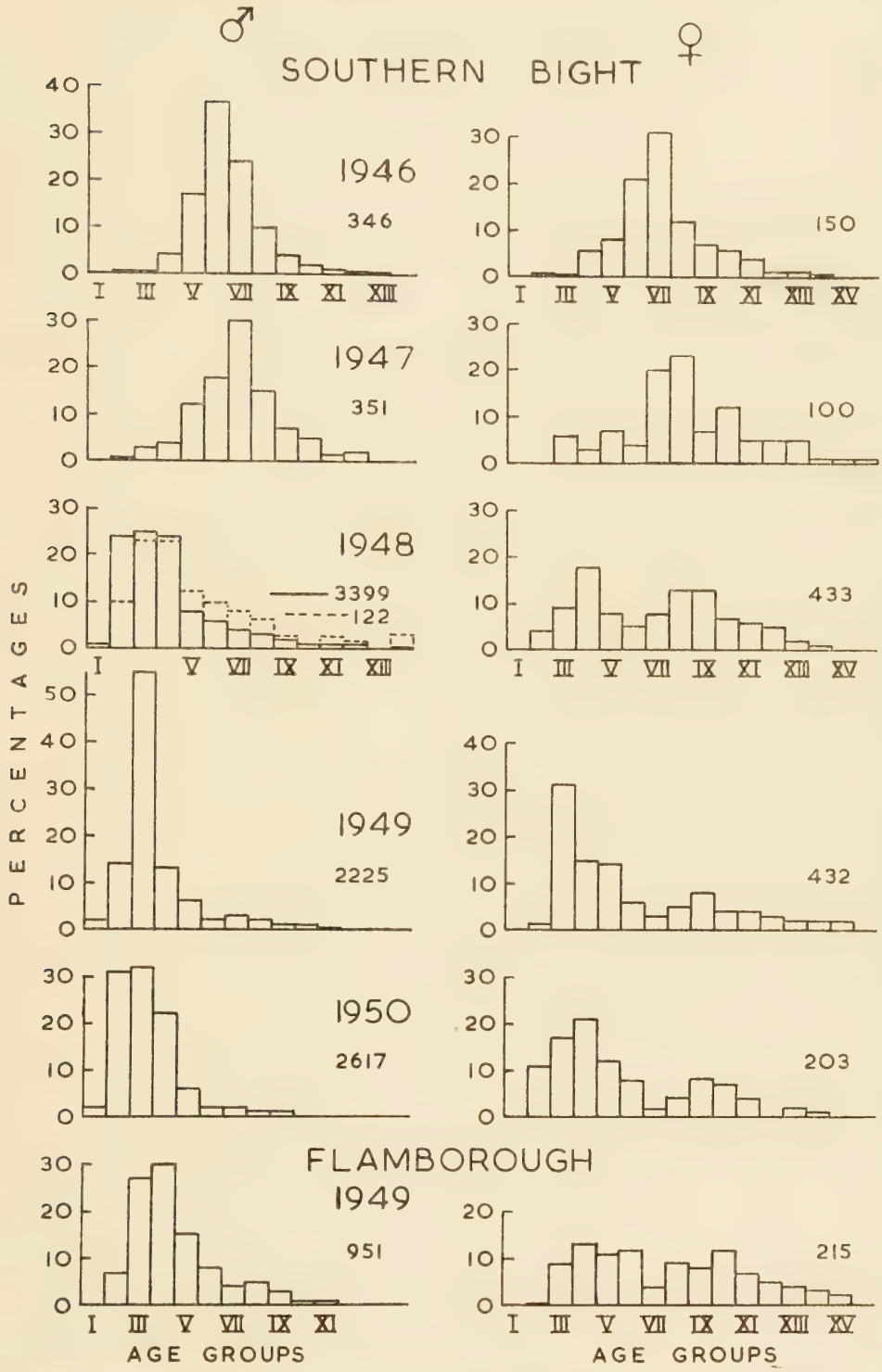


Fig. 40. *Percentage age composition of mature plaice from the Southern Bight and Flamborough spawning areas.*

1946, 1947 *from market samples.*
1948–1950. *from research ship samples with the data from a market sample of* 122 *males in* 1948 (*broken lines*).
The figures to the right of each histogram give the number of fish in the sample.

being caught, the trawling on the fifth survey, by being carried out at the same positions as on the previous two surveys, was south of the area of group I eggs at that time. As, however, about 40% of the mature females caught on this fifth survey were running ripe, and 60% were very recently spent fish, the catches from all four surveys have been summed to give an age composition of the spawning fish. The full data are set out as Appendix II, Table 3.

Owing to the greater weight of the SIR LANCELOT and the size of her trawl it was found in 1949 that trawling was not practicable over much of the centre of the Southern Bight spawning area where the PLATESSA had fished the previous year. Every haul attempted resulted in the trawl becoming extensively torn. It is almost certain that this tearing was due to the sand dune formation of the bottom in this area, which consists of ridges of such a size that large trawls heavy enough to lie close to the bottom for catching plaice dig into the tops of the sand ridges to such an extent that the net becomes torn. As a result of this difficulty the SIR LANCELOT worked the nearest trawlable ground north of the centre of spawning, and this was situated at the south-western end of the Brown Ridge. A 10 mile triangle of trawl hauls (Fig. 39) was made in this area on each cruise, immediately following the completion of the survey and trawling in the Flamborough area. The results are set out in Appendix II, Table 2.

The fact that the Brown Ridge trawling positions were north of the centre of spawning in the Southern Bight might be expected to give an age composition that was biased towards the younger fish (see Section VIIB), and therefore in 1950, when further plaice egg surveys were made in the Southern Bight, sampling of the fish was done in the same Brown Ridge area, but additional trawling was carried out at the nearest trawling ground south of the centre of spawning, the position worked being close to the North Falls bank (see Fig. 39). The results of these trawl hauls are set out in Appendix II, Table 4, and the data from the two positions has been summed to give the age composition shown in Fig. 40. In fact there was found to be little difference in the age composition of the areas north and south of the centre of spawning.

The age data of the females is based on insufficient numbers of fish for the strength of individual year classes to be used separately; however the general picture obtained does help to explain the changes in the stock during these years. They do show very clearly the rapid changes that were taking place in the spawning population in the years of heavy fishing that followed the partial protection of the stock during war-time (Margetts and Holt, 1948). In Fig. 40 the percentage age composition is given, while in Fig. 41 the data for the females are presented as absolute numbers by using the estimates of the total number of spawning females each year (table 7) and the per thousand age compositions (Appendix II, tables 1–4). The data for the males cannot be expressed in absolute numbers as no satifactory conversion figures are available.

Fig. 41 shows that in 1947 the younger fish were very poorly represented, the 1947 spawning population being dominated by the 1938 and 1939 year classes as group VIII and group VII fish. In 1948 considerable recruitment among younger fish had occurred while the older fish had been markedly reduced, so that group IV fish just outnumbered the 1938 and 1939 year classes. By 1949 the stock was predominantly young fish.

The change in the age composition of the males between 1947 and 1948 was even more striking. The mode at the 1939 year-class in 1946 and 1947 completely disappeared, being replaced in 1948 by the 1943, 1944 and 1945 year-classes as IV-, III- and II-group fish. This change might have been ascribed to the change in sampling from market samples to research ship samples, but it will be seen from the dotted histogram which has been included in Fig. 40 that the market samples in 1948 also showed this change to young fish, though the size limit imposed on commercially landed fish resulted in the commercial samples underestimating the II-group males.

The great abundance of the 1945 year-class in the samples trawled from the Brown Ridge area in 1949 seems to be exaggerated in view of the small numbers of this year-class present in 1948 and 1950, and it would seem probable that the 1945 year class, although clearly above average in abundance, was, for some reason, particularly common in this area in 1949.

The age composition of spawning plaice in the Flamborough area in 1949 closely resembled that of the Southern Bight in the previous year. It is interesting to note that the

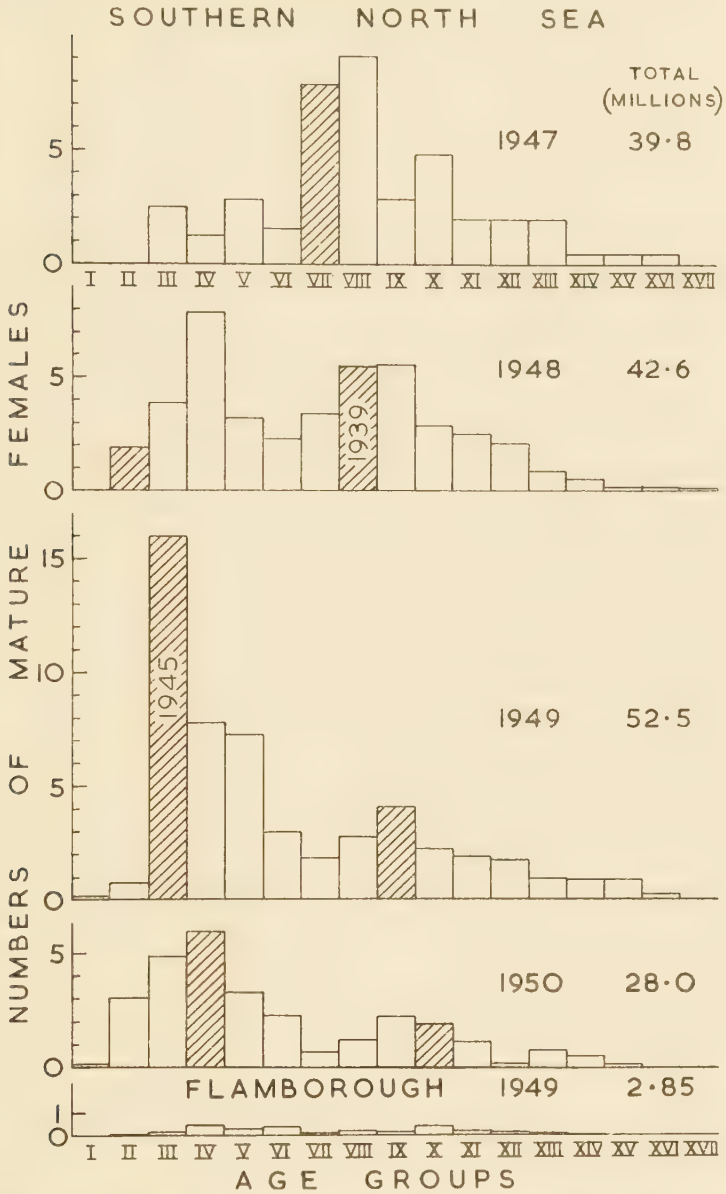


Fig. 41. *The numbers of mature females, in millions, in each age group taking part in the Southern Bight spawning in* 1947 *to* 1950 *and in the Flamborough spawning in* 1949.

1945 year-class (group III) was not as abundant as the 1944 year-class in the Flamborough area in 1949, though in that year the 1945 year-class dominated the scene in the Southern Bight. It would appear that the youngest year-classes represented in the Southern Bight spawning area are present to a considerably smaller extent, relatively as well as absolutely, in the Flamborough spawning area.

VI. THE RELATIVE IMPORTANCE OF THE SPAWNING AREAS

SINCE the spawning areas of the North Sea plaice cover a very wide area, and since spawning is proceeding in one or another area for about four months, from mid-December to mid-April, it is impracticable with normal resources to obtain an assessment of the egg production in all the areas in the same year. Therefore the assessment of the relative importance of the spawning areas is most readily made by using as the standard the general trend in annual egg production now established for the Southern Bight, and comparing the results of the surveys of the Borkum, Flamborough and eastern English Channel area with those years of the Southern Bight data which are most nearly contemporary.

The assessment would be relatively straightforward if it was known that the various areas always bore the same relationship to each other with regard to egg production. However, we do not know this and there is some evidence, as will be shown below, that the relative importance of the areas for egg production changes somewhat, with different degrees of exploitation of the stock.

The analysis of the age composition of the mature plaice on the spawning grounds of the Southern Bight and Flamborough areas showed that the age groups were not present in the same proportions in the two areas. The younger age groups were less well represented in the Flamborough area. This is shown in Table 8 where the percentages of the mature males that were groups II, III and IV and the percentages of mature females that were groups III, IV and V are shown for the two areas.

A similar comparison is not possible with the Borkum area, since the relevant data are not available for that area. However, Aurich (1941) reproduces some of Schmidt's (1938) data on the age composition of the mature plaice landed by the cutters from the eastern North Sea which, though not taken specifically from the spawning area may be taken as roughly representing the stock in this area. In the table presented by Aurich it is shown that typically (in the years 1930 to 1935 inclusive), the VIII and IX group plaice comprise only 1% or 2% of the mature plaice (defined as all plaice of group V and over) though in the exceptional years of 1936 and 1937 the very strong 1928 year-class raised this figure to 16% and 15% respectively.

Table 8: *The number of mature males and females that were in various age groups, expressed as a percentage of the total mature males and the total mature females respectively, in the Southern Bight and Flamborough areas.*

		Males II, III and IV groups	*Females III, IV and V groups*	*Numbers of group VIII and IX (males and females) expressed as a % of all mature plaice in group V and over*
Southern Bight	1948 – –	73	35	26
	1949 – –	82	59	22
	1950 – –	85	50	21
Flamborough	1949 – –	64	34	22

However, the VIII and IX year-classes represented over 20% of the Southern Bight spawning plaice of group V and over in all three years for which we have data, including 1950 when the war-time accumulation of older fish had been fished out. It is also seen that the comparable figure for the Flamborough area in 1949 was 22%, indicating that among the older fish the age composition of the spawners in the Flamborough and Southern Bight areas were similar.

These data suggest that, compared with the Southern Bight, the Flamborough spawning plaice include a smaller proportion of the younger fish, while the Borkum area includes a smaller proportion of older fish.

It seems most probable that these differences in the age compositions in the three spawning areas are the result of the general configuration of the North Sea, the water movements, and the behaviour of the plaice.

The main nursery grounds of the plaice are on the north coast of Holland and into the German Bight. As the young fish grow up they steadily move off from this coastline and, on becoming mature, start their annual spawning migration. The youngest mature fish, males of groups II, III and IV, and females of groups III, IV and V, are still largely south and east of the Dogger, and under the influence of the English Channel water penetrating the North Sea migrate to the Borkum and Southern Bight spawning areas, with a few migrating, under the influence of the more northerly water circulation, to the Flamborough area.

As the plaice grow older and move further from the nursery grounds there are fewer in the Danish coastal waters or the German Bight to be brought by the spawning migrations to the Borkum area, and they migrate either to the Southern Bight or to the Flamborough area, thus leaving the Borkum area short, by comparison, of older spawning fish.

This interpretation also partly explains why the Borkum spawning area has not become the centre of an important winter plaice fishery, although the number of plaice spawning there is high and the bottom is at least as suitable for trawling, if not more suitable, than the strongly ridged sand dunes of the southern part of the Southern Bight. The plaice spawning in the Borkum area have not attracted a big fishery because they are not the larger fish, they are mixed with very many undersized plaice and dabs, and the area is very exposed to bad weather.

The important implication of the above finding in the present context is that the relative importance of the North Sea spawning areas as egg producing areas will change with changes in the size of the plaice stock. During periods of light exploitation the proportion of older fish will increase and under these conditions the Flamborough area, and, to a lesser extent, the Southern Bight, will be expected to receive greater proportional increases in weight of spawners than the Borkum area. On the other hand, during periods of heavy exploitation the spawning areas nearest the nursery grounds, with the Borkum area most favourably situated, may be expected to maintain their importance more than the Flamborough area.

In the light of this dynamic balance between the spawning areas we may proceed to examine the data on annual egg production from the North Sea spawning areas, with a view to obtaining a measure of their relative importance.

The egg production in the Flamborough area in 1949 was $0{\cdot}39 \times 10^{12}$ eggs compared with $3{\cdot}66 \times 10^{12}$ in the Southern Bight in 1948 and $3{\cdot}35 \times 10^{12}$ in 1949 (estimated from catch per hundred hours' fishing). Thus, in 1949 the Flamborough egg production was about 11% or roughly 1/9th of the Southern Bight egg production. In years of heavier exploitation when female fish of eight years and older are much less than the 50% that they formed in 1949, the Flamborough area may be expected to contribute considerably less than the 11% that they did in 1949.

It has been possible to make two estimates of egg production in the Borkum area. The estimates for 1936 and 1953 were $1{\cdot}3 \times 10^{12}$ and $1{\cdot}8 \times 10^{12}$ eggs respectively. The 1936 figure for the Southern Bight was $1{\cdot}7 \times 10^{12}$, the lowest of the whole series. On direct comparison this gives an egg production in the Borkum area 76% of that in the Southern Bight in the same year.

Aurich (1941) discusses at considerable length the possibility of the Borkum spawning being inflated in 1936 as a result of the participation of large numbers of the rich 1928 year-class. However, he points out that the evidence for this inflation is not very definite and it would seem most probable that in 1936 the Borkum spawning area added at least 60% to the number of eggs laid in the Southern Bight in that year.

The estimate of $1{\cdot}8 \times 10^{12}$ eggs laid in the Borkum area in 1953 may be compared with the figure of $4{\cdot}1 \times 10^{12}$ for the Southern Bight in that year as calculated from the catch per

hundred hours in the spawning area. On this basis the egg production in 1953 in the Borkum area was about 45% of that in the Southern Bight. This value is probably too low since from Fig. 39 it would appear that the 1953 estimate of egg production in the Southern Bight was probably high, while Bohl's survey missed the peak of spawning and probably gave a too low value. Thus it seems probable that at times of moderate to heavy exploitation of the stock the egg production in the Borkum area is typically between 45% and 60% of that in the Southern Bight.

The spawning area in the eastern English Channel is not an independent spawning area, but is, in effect, a spill-over from the main Southern Bight area. However, the fact that only in 1936, 1938 and 1947, has it been surveyed sufficiently completely for the egg production to be assessed, has meant that in the earlier sections of this paper the Southern Bight spawning has been treated independently of its English Channel extension. The available figures for egg production in the eastern English Channel in these years were $0{\cdot}62 \times 10^{12}$, $0{\cdot}15 \times 10^{12}$ and $0{\cdot}62 \times 10^{12}$ respectively, which are 10%, 5% and 15% of the Southern Bight figures for the same years. Since the estimate of egg production in the Southern Bight in 1938 is probably high, it would appear that in the pre-war years the spawning in the eastern English Channel was at, or slightly below, 10% of that in the Southern Bight. However, in 1947, when the stock contained many older fish, the figure was in the region of 15%.

The fact that the eastern English Channel area is at a considerable distance from the main nursery ground, and the observations that spawning begins here earlier than in the main area (see p. 34), and that older fish in the Southern Bight tend to spawn before the younger ones (p. 47), all lead to the conclusion that here, as at Flamborough, the egg production may be expected to be greater relative to the Southern Bight spawning when the stock is lightly exploited than when it is heavily exploited.

In addition to these areas, there is a not unimportant extension of the Southern Bight area north of the arbitrary 53°N limit set on the surveys. The extension lies towards the western end of the Dogger Bank and towards the Borkum spawning area. The surveys of 1921 and 1950 and the German surveys have covered this area to a greater or lesser extent in different years and show its continuity with the Southern Bight area, especially in years of high egg production. In 1921 the continuity was strong, in 1950 the northern extension developed as the spawning south of 53°N drew to a close, while in 1936 the observations from the English research vessel showed that the Southern Bight spawning did not reach 53°N in that year, although Aurich's survey showed the existence of considerable spawning in the area just north of 53°N (Fig. 30).

Rough calculations from the data show that this extension north of 53°N (Botney Gut) must add about 17% to the Southern Bight spawning south of 53°N.

Bringing the figures from all the areas together, under conditions of moderate to heavy exploitation of the stock, the egg production in the various parts of the North Sea would be:—

	Percentage of Southern Bight	*As percentage of total*
Southern Bight	100	53
Borkum	53	28
Botney Gut	17	9
Eastern English Channel	10	5
Flamborough	10	5

In view of the dynamic nature of the relation between the spawning areas, and of the factors already enumerated that will alter the relative amounts of spawning in the different areas, these percentages give an impression of greater accuracy than they actually carry. It would be best to express the results in the statement that during periods of moderate to heavy exploitation of the stock, of all the plaice eggs laid in the North Sea just over half are laid between the Straits of Dover and 53°N, but that when this area is extended to include the extensions south into the English Channel and north to the Dogger Bank, it includes two thirds of the egg production. The Borkum area contributes between one quarter and one third and the Flamborough area one twentieth of the North Sea egg production, with an unknown small addition, probably about one twentieth, along the east Scottish coast.

VII. THE BEHAVIOUR OF SPAWNING PLAICE

A. THE AGE AT WHICH FEMALE PLAICE BECOME MATURE

DURING the early investigations into the biology of the plaice Kyle (1900, 1903) developed a method of determining the 'average length at first maturity'. This was obtained from a sample of fish by determining the size at which 50% were immature and 50% were mature. Wallace (1909) used Kyle's method and extended it to determine in the same way the average age at first maturity.

The result of Wallace's investigations was the determination of a series of values for different parts of the North Sea and the propounding of a 'hypothesis that there are two "races" of plaice, each characterised by the attainment of a certain average size at first maturity' (Wallace, 1909, p. 71).

In the concluding remarks of a later paper on the same subject Wallace points out that certain anomalies in the results obtained by this method may be 'the result of selective migration differentiating the immature and mature fish of the same size in such a way that the proportions of small mature fish tend to increase towards the southern end of the North Sea' (Wallace, 1914, p. 44). It is clear now that Kyle and Wallace were not measuring the age or length at first maturity but some function of the proximity to a nursery ground of each sample examined. As a result of the mature fish tending to leave the nursery grounds before the immature of the same size, the nearer one is to a nursery ground the larger is the proportion of immature fish in any size range, with a consequent increase in the size group containing 50% mature and 50% immature fish.

As there has been no further investigation of the age at which plaice mature in the North Sea, it is worth extracting from the present data what information there is on this question, although the small size of the samples make the deductions somewhat uncertain.

Examining the estimated numbers of female plaice spawning in the Southern Bight in each of the years 1947 to 1950 (Fig. 41), and using the estimate of 45% overall annual mortality for the plaice (M.A.F., 1953), we can obtain the numbers of the 1943 and 1944 year-classes which were spawning for the first time in each of these years.

If we follow the numbers of the 1943 year-class participating in the spawning in the years 1947 to 1950 we see that there were 2·4 million in 1947 as III group fish. Of these 45% were caught or died in the following 12 months, leaving 1·3 million to spawn in 1948 as IV group fish, with 6·7 million more 1943 year-class females spawning for the first time (total of 8·0 million group IV fish). Of these 8·0 million, 45% were caught or died in the following 12 months leaving 4·4 million to spawn as V group in 1949. The 7·3 million V group spawners in 1949 show that a further 2·9 million 1943 year-class plaice were spawning for the first time in 1949. The 2·3 million VI group spawning in 1950 being less than half the V group spawners in 1949 indicate that no further recruitment of 1943 year-class fish as first time spawners was occurring in 1950. The number of the 1943 year-class spawning for the first time as III, IV, V and VI group fish was, therefore, 2·4, 6·7, 2·9 and 0 million respectively. Similarly for the 1944 year-class the figures were 4·0, 5·5, 0 and 0 million. Expressing these as percentages of the year-classes one gets:—

	III	*IV*	*V*	*VI*
1943	20%	56%	24%	
1944	42%	58%		

While these estimates differ considerably, in each case over 50% of the whole year class spawned for the first time as group IV fish, that is, as fish which were just completing their fifth year of life. The presence of a few mature females as II group fish and even rarely as I group fish, and also a small number of immature females as group VI and rarely group VII, shows that the age at first maturity of females is in fact spread over age groups I to VII, though with little doubt over 80%, or even 90%, mature for the first time as group III, IV or V fish.

It may be expected that, as in the herring (Cushing and Burd, 1957) some variation in the mean age at first maturity may occur from year to year.

B. CHANGES IN THE AGE COMPOSITION OF THE PLAICE POPULATION DURING SPAWNING

During the analysis of the results of the trawl survey of the spawning plaice in 1947/48 in the Southern Bight it became clear that over the period of the survey, mid-December to mid-February, there had taken place a progressive change in the age composition of the mature fish on the spawning ground. In Fig. 42 are set out the age compositions of these fish at approximately fortnightly intervals, two or three surveys being taken together where

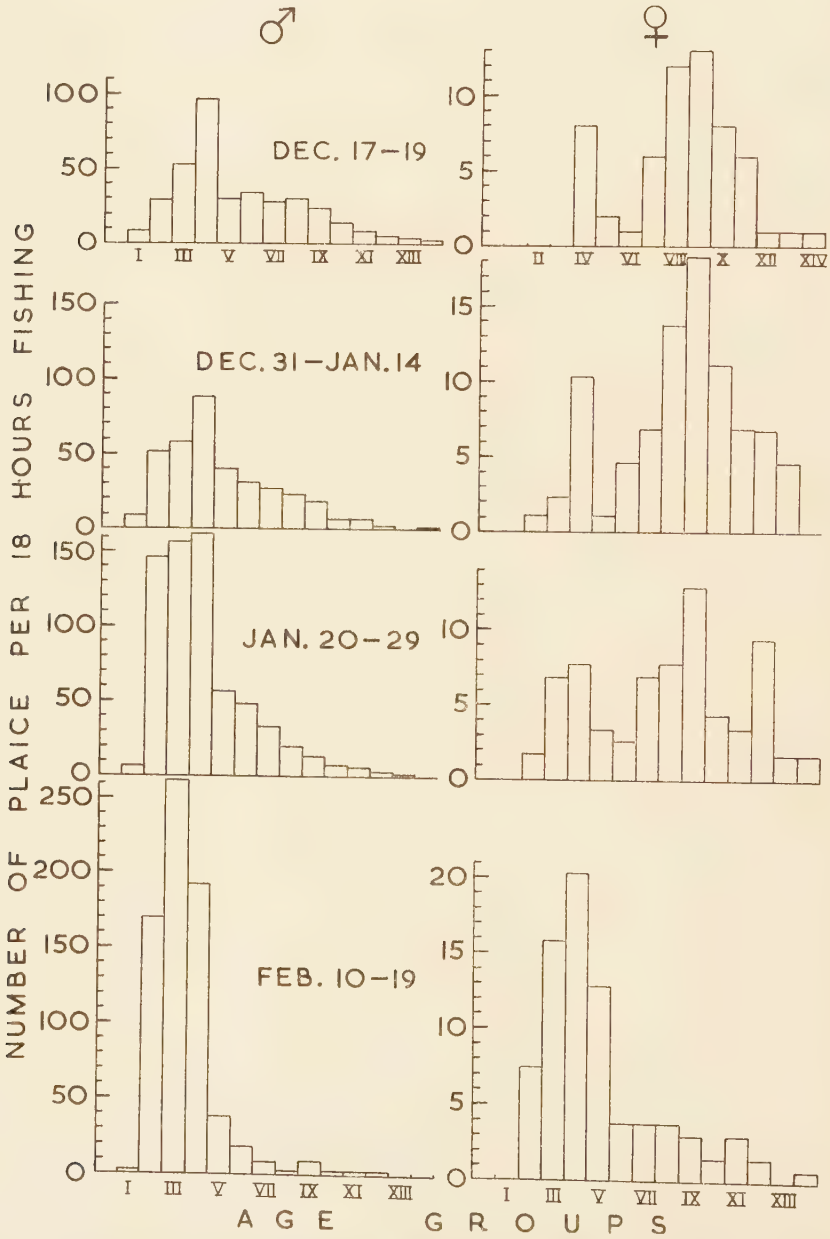


Fig. 42. *The catches per* 18 *hours' fishing of mature male and female plaice in the Southern Bight spawning area at approximately two week intervals between mid-December,* 1947, *and mid-February,* 1948.

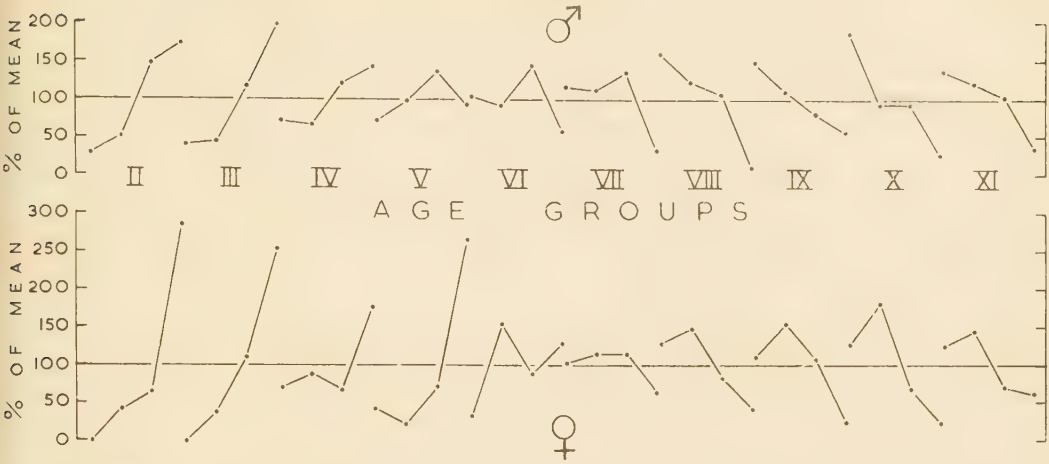


Fig. 43. *The relative changes in numbers of mature plaice in each age group over the period of the four surveys between mid-December,* 1947, *and mid-February,* 1948. *Each curve refers to the fish of one age group. The scale is the number of fish of one age group and sex caught on a survey, expressed as a percentage of the mean of numbers of the same age group and sex caught on each of the four surveys.*

necessary, and the catches being scaled to a common total trawling time of 18 hours within each time interval. It is immediately seen, especially among the females, that the predominance of old fish on the first survey is progressively reduced until, on the survey of 10–19 February, the catches were dominated by younger fish. This progressive change in the age composition was more clearly brought out by plotting separately the changes in number of each age group. This is done in Fig. 43 where for each age group separately, the catch per 18 hours' fishing is expressed as a percentage of the mean catch of that age group for the five surveys together. The curves are very regular for the males, where the numbers were large, and show rising curves for age groups II to V and falling curves for age groups VI to XI. The curves for the females, based on far fewer observations, are not so regular, but show similar trends, except that the change from rising curves to falling curves occurs at one year older, between age groups VI and VII.

Thus it is seen that while some plaice of nearly all age groups were present throughout the spawning, there was a marked tendency for the older fish to be present towards the start, with a progressive replacement of these by younger fish. That this was not only an illusion due to migration through the area was shown by replotting the data using only the fish actually in the process of spawning (i.e. running ripe) when caught, discarding all those fish which had not yet started to spawn and those which were spent. For males the curves produced differed very little from Fig. 43, as practically all males caught were running ripe. For females the numbers running ripe were too small to be used in this way and therefore the mean age of spawning females during each of the four periods was obtained and gave 7·5, 8·7, 8·2 and 5·1 years old respectively. Similar mean ages of actually spawning fish were calculated for the 1948/49 surveys and the results are tabulated below, table 9.

It is seen that the mean age rose slightly between mid-December 1947 and early January 1948, but all the other observations showed decreases in the mean age as the spawning advanced.

Wollaston has pointed out, and it was confirmed in the more recent data, that the centre of most spawning, as determined by the egg surveys, showed a progressive north-easterly movement during the successive surveys in each year. Combining these observations it would appear that while there are probably some mature plaice of all age groups to be found over all of the spawning area throughout the spawning period, there is a tendency for the older spawners to arrive first and to spawn further south-west and to be replaced progressively with younger plaice, spawning further and further towards the north-east. It is interesting to note here Verwey's observation that among most migratory birds and marine

Table 9: *The mean age of spawning plaice during the Southern Bight surveys in* 1947/48 *and* 1948/49. (*Numbers of fish used for the calculations in brackets*)

	1947/48		1948/49	
	Males	*Females*	*Males*	*Females*
Mid December . . .	6·7 (128)	7·5 (11)	4·8 (11)	12·0 (3)
1st half January . . .	6·9 (249)	8·7 (19)	3·9 (281)	7·2 (24)
2nd half January . . .	3·7 (246)	8·2 (31)	3·5 (400)	6·7 (30)
1st half February . . .	3·4 (360)	5·1 (19)	2·8 (198)	3·7 (18)

animals the younger ones arrive when the temperature is higher. Thus, during falling temperatures the young arrive first, while during rising temperatures the old arrive first. The plaice is an exception to this generalisation (Verwey, 1949).

C. THE SEX RATIO OF PLAICE ON THE SPAWNING GROUND

The existence of a high sex ratio in favour of males among spawning plaice is well known and has been used for determining the spawning areas of this species (Wallace, 1909).

Hefford (1909, p. 162, 1916, p. 35) discussed at length the possible causes of this unequal sex ratio and concluded that it was more likely that it was due to the males remaining longer on the spawning grounds than the females, rather than that the females were less readily caught. While this conclusion appears on the evidence to be the most probable explanation, it cannot be taken as proven. In this section, additional data are presented relating to this phenomenon.

During the present investigations trawl sampling was carried out in the spawning areas on five occasions, and the catches were analysed for sex, age and sexual maturity.

The sex ratios obtained were found to vary considerably between different spawning areas, between parts of the same spawning area, and from year to year in the same area. Part of this variation was the result of a variable amount of admixture of immature fish dependent on the proximity or otherwise of a nursery ground.

It is seen that the sex ratios are in several cases considerably altered when the immature fish are included; however, the variation in sex ratio is still present when only mature fish are considered. They varied between 4·4:1 for the mature fish in the Flamborough area in 1949 and 19·6:1 for the mature fish in the northern part of the Southern Bight in 1950.

If the sex ratios within age groups are considered, then the probable explanation of this variability among mature fish in different areas, positions and years, becomes apparent.

Fig. 44 shows the sex ratios for separate age groups and it is seen that the sex ratio is very high among the youngest fish and decreases very rapidly at first and slightly less rapidly after about age group V or VI, reaching unity at age group X and becoming less than unity among the older fish.

While the sex ratio at any one age was fairly constant, it will be clear that the sex ratio of all ages together in a spawning population will be dependent on the age composition of the spawning fish.

Thus in 1949 in the Flamborough area the relatively low proportion of young spawning fish resulted in a lower sex ratio (4·4:1) than that in the Southern Bight (7·1:1) in the same year, where the younger age groups comprised a larger proportion of the spawners. The very high sex ratio in 1950 in both parts of the Southern Bight spawning area that were sampled was the result of the continued decrease in the numbers of the older spawners, combined with a strong recruitment of the younger spawners.

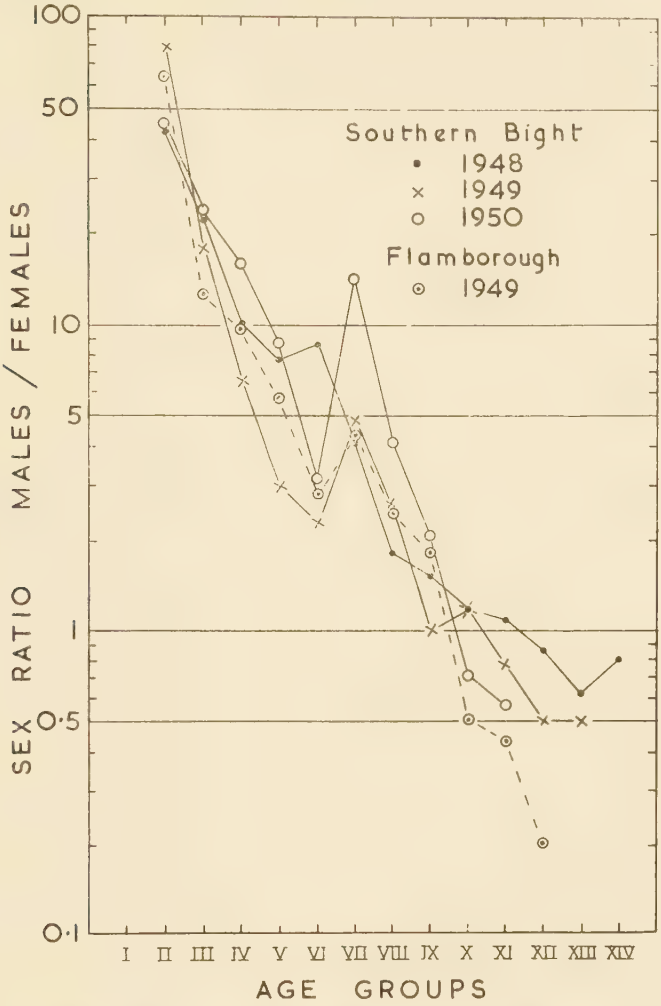


Fig. 44. *The ratio of mature males to mature females by age groups in the catches of plaice in the Southern Bight spawning area in* 1948, 1949 *and* 1950 *and in the Flamborough area in* 1949. (*Logarithmic scale*).

Table 10: *Sex ratio of plaice in the spawning areas*

Year	*Area*	*SEX RATIO (MALES : FEMALES)*	
		All fish	*Mature only*
1948	Southern Bight (western side) . .	7·3 : 1	7·9 : 1
1949	Southern Bight (northern end) . .	2·4 : 1	7·1 : 1
1949	Flamborough	1·3 : 1	4·4 : 1
1950	Southern Bight (northern end) . .	6·5 : 1	19·6 : 1
1950	Southern Bight (southern end) . .	8·5 : 1	10·5 : 1

From market samples taken during the summer it is evident that for the stock as a whole the sex ratio among younger plaice is about 1:1 but increases in favour of the females with increasing age, until ratios of 1:10 are found among the older fish. It would seem most probable that Hefford (1916, pp. 34–40) was correct in believing that this dominance of females among the older fish was the result of a higher mortality among the males during the fishing on the spawning stock.

If females remain on the spawning grounds for a constant fraction of the time that the males remained there, a fishery on the spawning fish would result in an increase in the sex ratio in favour of the females with increasing age, in the stock as a whole.

VIII. THE DRIFT OF THE EGGS

By comparing the distribution of eggs about to hatch (group V) on one survey with that of the youngest eggs (group I) on the previous survey, it has frequently been possible to estimate the drift of eggs that has occurred in the interval between the two surveys. This comparison, of course, only gives reliable results if the interval between the surveys corresponds to the time taken for the eggs to develop from the mid-point of group I to the mid-point of group V at the temperature of the water at the time. Often the dates have permitted this comparison to be made directly. However for those comparisons where the dates do not correspond it has generally been possible to use the data by taking the temperature of the water in an area of group V eggs, and from this estimating the date that these group V eggs were at group I stage of development, and working out the area that group I eggs would have covered on that date from the distribution of group I eggs on the surveys made immediately before and after that date. These calculations are now described in detail for those pairs of surveys where comparisons are possible, due to suitable timing. The results are summarised in table 11. Reference should also be made to the Appendix Figures.

1914. The temperature of the water within the '5' contour of group V eggs on the second survey was 5·8 to 6·2°C. These group V eggs, caught on 5 February, would have been group I eggs 14 days before—on 22 January—when the southern part of the first survey was being carried out.

The mass of group V eggs on the second survey lying between the 52° and 53° lines of latitude must have come from the mass of eggs within the 15 contour of group I eggs on the first survey, giving a movement to the north-north-east of about 40 miles. This gives an average drift of 2·9 miles per day for 14 days.

1921. The mortality of eggs in 1921 appears to have been very high and the interpretation of the relative distribution of group V and group I eggs in terms of drift is therefore made uncertain. Buchanan-Wollaston (1926, p. 10) deduced that in the 12 days prior to the second survey the eggs drifted some 18 miles to the NNE, while in the 13 days prior to the third survey the drift was some 37 miles to the NE, which figures are similar to those obtained by comparing the centres of distribution. These values give drifts of 1·5 m.p.d. for 12 days, followed by 2·8 m.p.d. for 13 days, giving an overall drift of 55 miles in 25 days, or about 2 m.p.d. for 25 days.

1936. The large area of group V eggs on 2–6 January must have come from group I eggs present 12 days before, that is, just after the December survey. By 2–6 January the distribution of group I eggs had extended considerably, but the centre was still south of 52°N, indicating a drift of eggs of some 55 to 65 miles NE during the 12 days prior to 2–6 January. That is an average drift of 5 m.p.d. for 12 days.

The 10–11 group V eggs per m^2 of the 16–23 January survey found at about 52°25′N could not have come from the smaller area of similar density eggs in the same locality on the previous survey (2–6 January), since this would indicate no mortality, and therefore they must have come from the concentration slightly south of 52°N, indicating a drift of 30 to 40 miles to the NE in 12 days.

Table 11: *Summary of the evidence on the drift of plaice eggs*

Year	*Period*	*Interval (days)*	*Drift (miles)*	*Drift per day (miles)*	*Direction (approx.)*
1914	22 January – 5 February	14	40	2·9	NNE
1921	11–23 January	12	18	1·5	NNE
	25 January – 7 February	13	37	2·8	NE
1936	23 December – 4 January	12	60	5·0	NE
	7–19 January	12	35	2·9	NE
1938	26 December – 9 January	13	12	0·9	NNE
	12–25 January	13	47	3·6	NE
1939	26 December – 9 January	14	25	1·8	NE
	9–22 January	13	47	3·6	NE
	20 January – 3 February	14	0	0	–
1947	28 December – 11 January	14	25	1·8	NNE
	10–25 January	15	14	0·9	NE
1948	27 December – 9 January	12	40	3·3	NNE
1950	6–20 January	14	0	0	–
	22 January – 6 February	14	70	5·0	ENE
	6–20 February	14	70	5·0	ENE
	22 February – 9 March	18	16	0·9	NNE
1952	14 February – 3 March	17	0	0	–
	4–21 March	17	60	3·5	NNE
ALL	—			2·4	Between NNE and ENE

1938. The intervals between surveys in 1938 were too great to get direct comparisons of group V eggs with group I eggs on the previous surveys. There is little doubt, however, that the small patch of group V eggs on the 7–11 January survey came from a position about half-way between that of the higher contours of group I eggs on the same and the preceding surveys. This gives a very small drift, of some 10–15 miles to the NNE, in the 13 days prior to the 7–11 January, or about 1 m.p.d. for 13 days. There was little change in the position of group I eggs between the surveys of 7–11 January and 22–27 January, and therefore the area of 5 group V eggs on the second of these surveys most probably came from an area centred about 52°N, giving a drift of 45 to 50 miles in 13 days, or about 3·5 m.p.d.

1939. The main concentration of group V eggs of the 5–12 January survey were group I on about 26–28 December, ten days after the first cruise of the winter. Thus the centre of group I eggs from which they were derived must have been about half-way between those

of the first two surveys, that is at about 51°45′N and 2°30′E. This gives a drift of some 25 miles in 14 days, or 1·8 m.p.d.

Between the next pair of surveys whose time interval is the development period, 13 days the kidney-shaped area of group V eggs must have come from the combined double area of group I eggs, giving a drift of 45 to 50 miles to the NE, equivalent to 3·6 m.p.d.

Between 19 January and 3 February there had been a complex movement with little suggestion of any residual drift. The movement between the last two surveys cannot be interpreted.

Thus, the movements that can be deduced between the first four surveys were 25, 45 to 50 and 0 miles in 14, 13 and 14 days respectively, and a total of 70 to 75 miles in 41 days, or between 1·7 and 1·8 miles per day for 41 days.

1947. From the first two surveys there is little doubt that the eggs were drifted about 25 miles NNE in the 14 days prior to 9–12 January.

The distributions of group I and group V eggs in the second and third surveys are very interesting; on the 22–28 January survey the distribution of group I and group V eggs were very different. It is seen from the distribution of the group I eggs on the two surveys that during these 15 days the area of spawning split up into three, while the eggs that were group I on the first survey remained as a single patch which was turned in a clockwise direction. The centre was carried some 14 miles to the NE.

The March survey was made shortly after the cessation of the strong easterly gales which persisted throughout most of February, and resulted in an unusual degree of cooling of the water in the North Sea (Vaux, 1953). The western area of group V eggs on this survey was in water of 2·5°C which means that they had been group I eggs some 20–25 days before, depending on the rate of cooling of the water. The distribution of group I eggs on the March survey indicates that while spawning had been extended into March, presumably as a result of the delaying effect of the cold, the two positions of spawning, one east of Lowestoft and the other off the Scheldt, had persisted and that the more westerly mass of eggs had hardly moved, while those off the Scheldt had been carried north-east towards the Dutch coast, north of the Schedlt. This is confirmed by the large number of plaice larvae and post-larvae caught on the more easterly stations on this March survey. There had apparently been a residual movement of the water to the eastward in spite of the easterly gales, which doubtless caused the water at the surface to move to the west. It seems most probable that this north-easterly movement of the water off the Dutch coast was a counter-current at least partly induced by the west-going water to the north of the Southern Bight. The tongue of water carrying no late stage eggs or any larvae, which occurred between the concentrations of group V eggs on the March survey, was also of relatively high temperature and salinity and had probably been moving north-north-east more rapidly than the water to the east and west. This question and others related to the effect of this cold winter on the fish eggs and larvae have been discussed separately (Simpson, 1953a).

1948. The more northerly area of group V eggs on the second survey (7–11 January) must have come from eggs about mid-way between the higher concentrations of group I eggs on the first two surveys, giving a drift of 40 miles to the NNE in 12 days or 3·3 m.p.d. Between the next two surveys the interval is twenty days compared with a developmental interval of thirteen days. With the change in position of spawning between these surveys it is not possible to deduce the drift with adequate certainty.

1950. Between the first two surveys there is no indication of any drift of the eggs, while between the next two surveys the large area of over 5 group V eggs can only have come from the group I eggs 70 miles WSW some 14 days previously, giving a movement of 5 m.p.d. Between the next two surveys the north-eastward movement continued at the same overall rate, the group V eggs at 53°N on 18–23 February being derived from the group I concentration just north of 52°N, again a movement of some 70 miles in 14 days. Between the last two surveys the drift was small, being 12 miles off the Scheldt and about 20 miles in the more westerly area.

1952. The drift of eggs in 1952 has already been discussed in detail (Simpson, 1953b). It was found that the drift between 12 February and 22 March was more complex than previously experienced. During westerly and north-westerly winds between 14 February

and 3 March, practically no residual movement occurred in the Southern Bight, while north of 53°N there was evidence of a drift of some 70 miles to the east in 17 days, or 4·1 miles per day.

Between 3 March and 21 March the eggs in the Southern Bight were drifted NNE at least 60 miles in 17 days, or at least 3·5 miles per day. The observations from the GAUSS reported by Dietrich (1953) overlapped this period, covering the interval from 28 February to 13 March. During this period several continuously recording current meters (Schaufelräder) were in position at 10 m depth in a line north-west from Den Helder. The third of these (No. 3403), at 53°32′N 3°51′E, most closely approximated to the position of the plaice egg drift observations and here a residual current over the 15 days was found to be 12·1 cm/sec in a north-easterly direction; this is 5·7 sea miles per day. As the period of the German observations covered several days of strong gales, their 5·7 m.p.d. is satisfactorily close to the minimum estimate of 3·5 miles per day deduced from the egg movements over 17 days which included 2 extra days with relatively little movement.

It is seen that the movement of the eggs, taken over periods of 12 to 17 days, varied between 0 and 5 miles per day in directions between NNE and ENE. In no case was there evidence that the eggs were drifted on to the shores of the Southern Bight; instead the eggs are seen to have been drifted with remarkable regularity for a greater or lesser number of miles approximately parallel with the continental coastline, though tending to approach it off Texel Island.

The average drift for all the observations was 2·4 miles per day, which means for 60 days of pelagic life at about 6·5°C an overall drift of some 144 miles. This drift would bring eggs from the centre of the Southern Bight spawning (52°N 2°50′E) to a position at about 54°N and 5°E. The shift in the position of spawning during January and February and the lengthening of the pelagic phase due to falling temperatures would be expected to result in larvae derived from the Southern Bight being distributed over a very wide area parallel to the continental coastline, but some 20 to 40 miles from it. The plaice spawned in early January towards the Straits of Dover and developing at temperatures between 9°C and 6°C would most often become demersal off the Dutch coast south of Texel, while successively later spawned eggs would be laid further north-east, and, developing more slowly due to lower temperatures, the resulting young fish would become demersal off the north coast of the Netherlands and into the German Bight.

The times at which strong north-easterly water movements occurred between late December and mid-May would determine the final distribution of the year's plaice brood along the continental nursery ground. In years of persistent north-easterly water movements, particularly in January and February, the more southern Dutch nursery grounds might well receive few young plaice, while the Dutch north coast and German Bight would become densely populated. In other years when the water movements were at a minimum in January and February the Dutch nursery grounds around and south of Texel Island would become densely populated with young plaice. This mechanism would produce, in successive years in any one part of the nursery grounds, year classes of varying strengths, although, taking into account the whole continental area, the year classes were of equal strength.

It would appear that while a considerable proportion of the products of the Southern Bight spawning may typically be transported to positions off the north Dutch coast and perhaps as far as Helgoland, it would be the exception rather than the rule that many would reach the eastern side of the German Bight or the coast of Denmark. The plaice here are presumably chiefly derived from the Borkum spawning.

An important implication of this study of the drift of the planktonic eggs and young fish relates to studies of the relative strengths of the year-classes of the plaice. Such studies, if using the younger year-classes off the Dutch, German or Danish nursery grounds, must take into account the variable distribution of the products of the spawning areas. It may be taken as certain that identical overall survival of year-classes of identical original strength as spawned eggs may be expected to give different numbers of young fish in different parts of the nursery ground. This was appreciated by Bückmann and Kotthaus (1935), but has not been taken into account in the recent studies by Carruthers *et al.* (1951) on the survival of plaice.

IX. SOME PRINCIPLES INVOLVED IN FISH EGG SURVEYS

THERE is now an increasing amount of research being done which for one or another reason has included fish egg surveys, and, with the present review of one investigation which has extended intermittently for over 40 years, it may prove useful to discuss briefly the wider aspects of this type of investigation.

A study of the spawning of fish can have one or more of three main aims. These are:—

1. The determination of the time and places of spawning.
2. The determination of the annual egg production to obtain an absolute measure of the adult stock.
3. The determination of the annual egg production as the starting point for the study of the fate of the eggs and larvae, their mortalities and drift.

The first is essential to the success of the second two.

The determination of the time and place of spawning needs to be approached at first with an emphasis on breadth of sweep rather than accuracy of sampling. The differences in abundance of eggs in and out of a spawning area and between the peak of spawning and the beginning and end of spawning are sufficiently great for quite crude methods to give the limits with adequate precision. The important feature of such an investigation is to spread the surveys wide in space and long in time so that the limits of each are covered. This may mean tackling different areas or seasons in different years, unless, as in the case of the more recent Pacific pilchard investigation, several ships are available.

Sette's and Ahlstrom's (1948) earlier investigations into the abundance of eggs of the Pacific pilchard had value primarily for working out methods of evaluating egg production. Later the co-operative programmes of 1950 onward permitted adequate coverage of the 1,000 miles of coastline between San Francisco (37°N) and Southern California (23°N) and put the earlier survey, which was limited to an area some 140 miles long, into perspective.

The surveys of the mackerel and pilchard spawning in the Celtic Sea (Corbin, 1947), while giving a useful picture of the spawning in a limited area, could have produced more information for no more effort if the area covered had been twice as great with stations much more widely spaced, and if the surveys had been spaced to cover more of the year rather than repeated over nearly the same area and period for three years.

In his outstanding study of the eggs and young of the mackerel off the east coast of the U.S.A., Sette spent two years surveying the coastal waters to determine the main spawning areas, and a third confirming his findings, before he embarked on a full scale study of the mortalities of the eggs and larvae of this fish (Sette, 1943). The preliminary work had found that the main spawning areas were quite different from those thought to be the most important before his investigations began.

A feature of those studies that have covered a major spawning area throughout the spawning season has been the existence of a consistent change in the position of the spawning area as the spawning season progressed. It has been shown in this paper how the plaice spawning area moves north-east through the Southern Bight of the North Sea, and north of Flamborough, during the spawning period. Sette (1943, p. 159) found that off the coast of southern New England and the middle Atlantic states the spawning of the mackerel begins in April in the southern end of the area (37°N) and progresses northward along the continental shelf, reaches its peak in May off New York (40°30′N) and ends in June off southern Massachusetts (43°N). Corbin found that the spawning of the mackerel in the area south-west of Britain moved eastward from the edge of the continental shelf, some 100 miles offshore, to eastward of Land's End. The investigations on the Pacific pilchard off California (1950 Progress Report, Figs. 28–33) showed that while some spawning continued off Punta San Eugenio throughout the spawning period, February to July, the spawning began in this area (27°30′N) and spread northward along the coast, reaching Point Conception (35°N) in May and San Francisco (37°N) in June and July.

Having determined the time and position of spawning, investigations aimed at quantitative data on egg production need to make full use of this information, and to change to

precise quantitative sampling, taking care that the number of samples is adequate to keep random sampling errors to a minimum and that sources of directional errors are either eliminated or allowed for.

Assessments of annual egg production have now been made for several species and these investigations have demonstrated how important it is for the greatest care to be taken in planning the surveys. The surveys of the Pacific halibut egg production (Van Cleve and Seymour, 1953) would have gained much if such precautions had been adequate (Simpson, 1954).

Sette and Ahlstrom (1948) have shown that the calculation of egg production from the field observations can be greatly simplified if a regular grid of stations can be worked; however the limits of the grid need to be flexible to allow it to cover the spawning at the time of each survey without fear of omitting significant parts of the spawning area, while not wasting undue time on or beyond the limit of spawning. This has been achieved in recent plaice egg surveys in the North Sea and Irish Sea by making an immediate check on the eggs being caught at a station before proceeding to the next station on the grid, especially when the outer edges of the grid are being worked.

In all quantitative estimates of egg production it is necessary to know the relation between the rate of development of the eggs and the temperature, information which can quite readily be obtained by simple experiments, in order to allow for the differences in temperature from year to year. Further, with species in which the rate of development of the egg is fast, or when only very young stages of egg are being used for calculations, it is likely to be necessary to allow for the diurnal spawning behaviour of the fish. Sette and Ahlstrom (1948) found this to be of great importance, since the eggs of the Pacific pilchard took less than three days to hatch when the temperature was over 15°C and spawning was mainly restricted to the 4 hours before midnight.

X. SUMMARY

1. From plaice egg surveys in eleven spawning seasons it was found that spawning in the Southern Bight of the North Sea became of significant proportions between the 12 and 15 December, that it reached its peak during the second half of January and usually ceased during the first week in March. The comparable dates for the Borkum (German Bight) and Flamborough spawning areas were about 1 month later.
2. The total annual production of eggs in the Southern Bight was found to be about $2{\cdot}2 \times 10^{12}$ during the period of intense fishing in the late 1930's, and between 8 and 10×10^{12} during the two periods of light fishing in the 1914–18 and 1939–45 wars. After the latter war the egg production settled down during the mid 1950's to a level of about $3{\cdot}5 \times 10^{12}$.
3. Data on the fecundity, age and length compositions of the spawning fish were used with the egg production data to show the changes in absolute numbers of females of each age group taking part in the spawning in the years 1947 to 1950.
4. It is suggested that there is a dynamic equilibrium between the three main spawning areas in the North Sea, due to their positions relative to the main nursery ground, such that the Borkum spawning area has the highest proportion of young fish and the Flamborough area the smallest, the Southern Bight being intermediate.
5. It is estimated that in periods of fairly heavy fishing some 58% of all the eggs laid occur in the Southern Bight spawning area and its extension into the English Channel, some 37% in the Borkum area and its extension to the Botney Gut, and 5% in the Flamborough area.
6. New data are presented which show that in the southern North Sea females mature for the first time over the range of age groups I to VII, but that over 50% mature for the first time while in the age group IV, at the end of their fifth year of life.

7. It was found that there is a tendency for the older males and females to spawn earlier than the younger ones.
8. The sex ratio of catches of mature plaice on the spawning ground fell from over 10:1 (males:females) for group III fish to 1:1 for group X fish. Among plaice over group X there was a predominance of females.
9. A comparison of the distribution of recently laid eggs as found on one survey with that of eggs about to hatch, as found on the following survey showed that on the average plaice eggs in the southern Bight were drifted 2·4 miles per day, in directions between NNE and ENE; though over the two-week periods used the drifts varied between nil and 5·0 miles per day.
10. The efficiency of commercial steam trawlers fishing the spawning stock is estimated to have increased by a factor of 2·7 times in the interval between 1914/21 and 1935/50. (p. 33).

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APPENDIX I

'GEORGE BLIGH'. *Cruise B.* 1935. 19–23 *January*

Day	Station	Position °N ′	Position °E ′	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
19	1	50 54	01 32	19	7·6	34·35	4	3	0725	1, 2	17	–	–	–	–	–	–	–	–	–	–
19	2	51 01	01 30	33	9·4	35·08	4	3	0830	1	30½	2	–	1	–	5	–	3	–	4	–
										2	30½	1	–	–	–	1	–	–	–		
19	3	51 09	01 29	18	8·0	34·92	4	3	1010	1, 2	16	–	–	–	–	–	–	–	–	–	–
19	4	51 05	01 38	24	9·4	35·18	4	3	1110	1	22	3	1	5	5	6	3	1	–	11	8
										2	22	4	–	3	4	4	3	4	–		
19	5	51 01	01 49	19	7·7	34·58	3/4	3	1240	1	17	–	–	–	–	1	–	1	–	–	–
										2	17	–	–	–	–	1	–	–	–		
19	6	51 12	01 43	20	9·5	35·28	3/4	3	1405	1	17½	–	–	2	3	2	2	1	–	7	5
										2	17½	2	2	–	3	2	1	–	–		
19	7	50 55	01 16	20	8·6	35·04	3	3/2	1730	1	17½	2	–	–	–	–	–	1	–	5	–
										2	17½	1	–	–	–	–	–	1	–		
19	8	50 52	01 00	19	8·6	35·11	3	3	1850	1, 2	17	–	–	–	–	–	–	–	–	–	–
19	9	50 47	01 17	16·5	8·9	35·02	3	3	2045	1, 2	14	–	–	–	–	–	–	–	–	–	–
19	10	50 45	01 29	20	8·3	34·59	3	2/3	2200	1, 2	17½	–	–	–	–	–	–	–	–	–	–
19	11	50 31	01 22	20	8·9	34·86	2	3	2352	1	17½	–	–	–	–	–	–	1	–	–	–
										2	17½	–	–	–	–	1	–	–	–		
20	12	50 17	01 13	24	9·1	35·01	2	3	0150	1	22	–	–	–	–	1	–	–	–	–	–
										2	22	–	–	–	–	–	–	1	–		
20	13	50 25	00 56	20	9·4	35·48	2	3	0330	1	17½	1	1	–	–	–	–	1	–	7	–
										2	17½	2	–	–	–	–	–	1	–		
20	14	50 32	00 40	29	9·7	35·12	2	3	0510	1	27	5	1	1	2	2	1	–	–	11	3
										2	27	1	–	1	2	1	1	1	–		
20	15	50 40	00 24	16	8·2	35·01	2	3	0710	1	13½	–	–	1	–	–	–	–	–	–	–
										2	13½	–	–	–	–	–	–	–	–		
20	16	51 20	01 36	12	7·3	34·66	3	3	1410	1, 2	10	–	–	–	–	–	–	–	–	–	–
20	17	51 22	02 00	24	9·4	35·11	3	3	1605	1	22	–	–	1	–	–	–	–	–	3	2
										2	22	2	–	–	1	–	1	1	–		
20	18	51 23	02 25	20	7·9	34·69	3	3	1800	1	18	1	–	–	–	–	–	–	–	5	2
										2	18	2	–	1	–	–	1	–	–		
20	19	51 33	02 11	26	9·4	35·10	2	3	1950	1	24	1	–	–	–	–	–	–	–	5	–
										2	24	2	–	1	–	–	–	–	–		
20	20	51 44	01 59	22	9·5	35·14	2	3	2155	1	19½	–	–	1	–	–	–	–	–	–	–
										2	19½	–	–	–	–	–	–	–	–		
20	21	51 40	02 17	26	9·3	35·16	3	3	2330	1	24	3	1	3	1	1	–	–	–	8	–
										2	24	1	–	2	1	–	–	–	–		
21	22	51 39	02 32	23	8·9	35·12	3	3	0050	1	21	5	2	1	1	1	–	–	–	20	–
										2	21	2	3	3	1	2	–	1	–		
21	23	51 44	02 58	20	8·7	35·10	4	4	0235	1	17½	4	3	–	2	3	–	–	–	14	–
										2	17½	3	1	–	1	–	–	–	–		
21	24	51 49	03 24	19	8·0	34·99	4	4	0420	1	17	4	2	2	3	2	–	–	–	29	1
										2	17	10	7	1	4	–	1	–	–		
21	25	51 52	02 58	21	8·8	35·03	4	4	0630	1	18½	7	–	1	3	–	–	–	1	20	–
										2	18½	7	2	3	7	2	–	–	–		
21	26	51 55	02 33	27	9·6	35·20	4	4	0845	1	24½	5	–	3	1	–	–	–	–	11	–
										2	24½	4	–	–	–	1	–	–	–		
21	27	51 59	02 05	20	8·5	35·19	4	4	1056	1, 2	17½	–	–	–	–	–	–	–	–	–	–
21	28	52 00	02 41	26	9·1	35·08	4/5	4	1355	1	24	7	2	8	8	2	–	–	–	27	–
										2	24	8	5	3	4	2	–	–	–		
21	29	52 01	03 17	20	8·4	35·08	4	4	1655	1	18	–	1	1	2	2	2	–	–	6	5
										2	18	2	2	4	2	1	2	–	–		
21	30	52 02	03 52	13	7·3	33·23	4	4	1935	1, 2	11	–		–	–	–	–	–	–	–	–
21	31	52 08	03 05	21	8·7	35·04	4	4	2330	1	18½	7	3	3	2	3	1	–	–	18	1
										2	18½	2	2	6	1	3	–	–	–		
22	32	52 12	02 33	29	9·3	35·19	5	4	0215	1	27	9	4	3	3	3	1	–	–	30	1
										2	27	14	–	9	7	5	–	1	–		
22	33	52 17	02 03	21	7·0	34·59	4	4	0500	1, 2	18½	–	–	–	–	–	–	–	–	–	–
22	34	52 21	02 18	23	7·3	34·67	4	4	0635	1, 2	21	–	–	–	–	–	–	–	–	–	–
22	35	52 23	02 52	26	9·3	35·19	4	4	0910	1	23½	6	3	3	5	3	1	4	–	25	5
										2	23½	9	2	4	2	2	3	4	–		
22	36	52 25	03 23	19	9·5	35·03	4	4	1145	1	17	3	1	1	–	2	1	1	–	13	1
										2	17	6	–	3	–	1	–	1	–		
22	37	52 27	03 55	16	7·9	34·96	4	4	1420	1	13½	–	–	–	–	–	–	–	–	–	–
										2	13½	–	–	1	–	–	–	–	–		
22	38	52 29	04 26	11	6·6	32·46	3	3	1640	1, 2	8½	–	–		–	–	–	–		–	–
22	39	52 46	04 17	14	7·2	34·06	3	3	1840	1, 2	12	–	–	–	–	–	–	–	–	–	–
22	40	52 57	04 18	17	7·8	34·54	3/4	3	2020	1	15	–		–	–	–	–	–	–	2	–
										2	15	1	–	–	–	–	–	–	–		
22	41	52 54	03 43	20	8·4	35·19	3	3	2307	1	18		1	3	–	2	–	–		12	–
										2	18	3	3	3	2	–	–	1	–		
23	42	52 49	03 09	18	8·9	35·19	2	2	0200	1	16	2	4	4	2	–	1	–	–	17	2
										2	16	3	1	3	3	–	–	1			

'GEORGE BLIGH'. *Cruise S.* 1935. 17–20 *December*

Day	Station	Position °N	Position °E	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
17	2	50 32	00 40	25	9·98		2	2	0812	1	23	1	–	–	–	1	–	–	–	2	–
										2	23	–	–	1	–	–	–	–	–		
										3	23	–	1	–	–	–	–	–	–		
17	3	50 25	00 56	30			2	2	1017	1	28	1	–	–	–	–	1	–	–	3	3
17	7	50 55	01 31	26			3	3	1719	1	24	–	–	2	2	–	–	–	–	–	–
17	8	50 48	01 16	15	9·06		3	3	1920	1	12½	–	–	1	1	–	–	–	–	–	–
17	10	50 55	01 16	18			3	3	2234	1	16	1	1	1	–	–	–	–	–	7	–
18	11	51 01	01 31	28			4	3	0200	1	25½	1	–	–	–	–	–	–	–	3	–
18	15	51 12	01 42	22			3	3	0800	1	19½	1	–	–	–	1	–	–	–	3	
18	17	51 23	02 00	21	9·01		3	2/3	1305	1	18½	5	3	–	2	–	–	–	–	14	1
										2	18½	2	–	1	1	–	–	–	–		
										3	18½	1	1	2	1	–	1				
18	19	51 34	02 12	20	9·13		3	3	1715	1	18	2	3	1	1	–	1	–	–	7	2
										2	18	–	–	1	–	2	–	–	–		
										3	18	–	1	1	3	2	1	–	–		
18	21	51 42	02 16	20	9·18		3	3	2020	1	18	–	–	–	–	–	–	–	–	2	1
										2	18	1	1	–	–	–	–	–	–		
										3	18	–	–	–	–	–	1	–	–		
18	22	51 39	02 33	18			3	3	2258	1	16	–	–	–	1	1	–	–	–	–	–
19	25	51 53	02 59	21			3	3	0335	1	18½	2	1	–	–	–	–	–	–	10	–
19	26	51 55	02 33	21			3	3	0526	1	18½	1	1	–	–	1	–	–	–	7	–
19	28	52 01	02 41	23	8·87		2	2	1045	1	21	4	–	1	–	–	–	–	–	4	–
										2	21	–	–	–	–	3	–	–	–		
										3	21	–	–	–	–	2	–	–	–		
19	29	52 04	03 16	17			2	2	1320	1	15	1	–	–	–	–	–	–	–	3	–
19	32	52 12	02 32	22			2	2	2200	1	19½	2	–	–	–	–	–	–	–	7	–
20	35	52 21	02 53	20	8·71		3	3	0408	1	18	–	–	1	3	–	–	–	–	–	–
										2	18	–	–	–	1	–	–	–	–		

'GEORGE BLIGH'. *Cruise A.* 1936. 2–5 January

Day	Station	Position °N	Position °E	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
2	2	50 31	00 40	21	9·54		3/4	3	1030	1	21	–	3	1	3	–	–	–	–	9	–
										2	21	–	2	–	1	1	–	–	–		
										3	21	–	4	4	2	2	–	–	–		
2	3	50 23	00 55	21			3/4	3	1230	1	18½	–	1	–	1	–	–	–	–	3	–
2	7	50 56	01 30	29			2	2	1840	1	27	–	1	1	3	5	1	–	–	3	3
2	8	50 48	01 16	15	9·44		3	2	2020	1	13	1	–	1	–	–	–	–	–	1	–
										2	13	–	–	–	1	–	–	–	–		
2	9	50 51	01 00	18			3	3	2205	1	16	3	–	1	4	–	–	–	–	10	–
2	10	50 55	01 16	17			2	2	2340	1	15	1	1	1	2	–	–	–	–	7	–
3	11	51 01	01 31	27			2	2	0135	1	24½	1	1	–	4	1	–	–	–	7	–
3	13	51 05	01 39	20	9·33		2	2	0350	1	18	–	3	2	1	–	–	–	–	3	–
										2	18	–	–	–	2	–	–	–	–		
										3	18	–	–	–	–	1	–	–	–		
3	15	51 12	01 43	24			2	2	0615	1	22	–	1	1	3	3	–	–	–	3	–
3	17	51 23	02 00	21	9·18		2	2	0910	1	19	–	5	–	–	1	–	–	–	21	6
										2	19	1	6	–	–	3	1	–	–		
										3	19	4	3	1	2	3	4	–	–		
3	19	51 34	02 11	20	9·13		2	2	1255	1	18	–	3	–	2	1	1	–	–	4	2
										2	18	–	1	–	–	–	1	–	–		
3	20	51 44	01 59	17			2	2	1433	1	15	–	–	1	–	2	1	–	–	–	3
3	21	51 41	02 16	20	8·96		2	2	1557	1	18	–	3	5	–	1	–	–	–	20	–
										2	18	8	2	4	3	2	–	–	–		
										3	18	1	4	3	3	1	–	–	–		
3	22	51 39	02 32	21			2	2	1740	1	19	1	1	2	2	–	–	–	–	7	–
3	23	51 44	02 57	17			2	2	1930	1	15	1	–	–	–	–	–	–	–	3	–
3	24	51 49	03 26	15			2	2	2130	1	13	–	1	1	–	–	–	–	–	3	–
3	25	51 53	02 59	17			2	2	2335	1	15	1	1	–	–	–	–	–	–	7	–
4	26	51 55	02 33	21			2	2	0140	1	19	2	6	3	1	–	–	–	–	27	–
4	28	52 00	02 42	21	8·17		3	3	0815	1	19	1	6	1	7	3	1	–	–	20	4
										2	19	2	6	3	4	4	1	–	–		
										3	19	2	1	8	6	5	2	–	–		
4	29	52 02	03 17	17			3	3	1050	1	15	–	–	1	2	–	–	–	–	–	–
4	31	52 07	03 08	18			4	4	1715	1	16	–	2	2	–	–	–	–	–	5	–
4	32	52 11	02 32	21			4	4	2005	1	19	–	–	–	1	–	–	–	–	–	–
4	33	52 18	02 03	20			3	3	2320	1	18	–	–	–	–	–	1	–	–	–	3
5	35	52 21	02 52	21	8·40		2	2	0305	1	19	1	–	1	4	2	1	–	–	6	3
										2	19	–	2	–	1	1	1	–	–		
										3	19	2	–	1	1	1	1	–	–		
5	36	52 26	03 23	17			2	2	0530	1	15	–	3	1	–	3	3	–	–	10	10
5	37	52 27	03 55	14			3	3	0730	1	12	1	–	–	1	–	–	–	–	4	–
5	39	52 40	04 18	14			3	3	1115	1	12	–	–	–	1	–	–	–	–	–	–
5	41	52 54	03 42	15			4	4	1910	1	13	–	–	–	–	2	5	–	–	–	13
5	42	52 50	03 09	17	8·43		5	5	2155	1	15	–	–	–	–	1	1	–	–	1	1
										2	15	2	–	1	2	1	1	–	–		
										3	15	–	–	1	1	5	–	–	–		

'GEORGE BLIGH'. *Cruise B.* 1936. 17–23 *January*

Day	Station	Position °N ′	Position °E ′	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
17	2	50 32	00 40	23	9·24	35·11	3	2	0050	1	21	2	2	1	1	–	1	–	–		
										2	21	1	2	2	–	1	–	–	–	8	2
										3	21	–	–	2	–	–	1	–	–		
17	3	50 23	00 56	20	8·97	35·11	3	2	0235	1	18	–	1	1	2	4	–	–	–	3	–
17	4	50 17	01 13	17	8·12	34·43	3	2	0420	1	15	–	–	1	–	–	–	–	–	–	–
17	5	50 31	01 21	18			4	4	0635	1	16	–	–	–	–	–	–	–	–	–	–
18	7	50 57	01 30	30			2	4	1540	1	28	–	1	–	–	–	–	–	–	3	–
18	8	50 48	01 16	17	8·53	35·11	2	5	1315	1	15	–	–	1	–	–	–	–	–		
										2	15	–	–	–	–	2	1	–	–	–	1
18	10	50 55	01 16	18			2	4	1428	1	16	1	–	–	–	1	–	–	–	3	–
18	11	51 01	01 30	30			2	4	1627	1	28	–	–	–	1	1	–	–	–	–	–
18	13	51 05	01 36	22	8·53	35·16	2	3	1825	1	20	–	–	–	–	–	–	–	–		
										2	20	–	–	–	–	1	–	–	–	–	1
										3	20			–	–	1	1	–			
18	15	51 12	01 42	20			2	3	2110	1	18	–	1	–	–	–	–	–	–	3	–
19	17	51 22	02 00	20	8·48	35·19	2	2	0025	1	18	–	–	1	1	1	–	–	–		
										2	18	–	–	–	–	–	–	–	–	–	–
										3	18	–	–	2	–	1	–	–	–		
19	18	51 23	02 25	17			2	2	0230	1	15	–	1	–	–	–	–	–	–	3	–
19	19	51 33	02 11	23	8·44	35·19	2	2	0410	1	21	–	–	–	–	–	–	–	–		
										2	21	–	–	1	–	–	–	–	–	1	–
										3	21	–	1	–	–	–	–	–	–		
19	21	51 41	02 16	20	8·20	35·20	2	2	0820	1	18	–	1	1	2	–	1	–	–		
										2	18	–	2	–	2	–	1	–	–	6	2
										3	18	–	2	1	1	1	–	–	–		
19	22	51 39	02 31	22			2	2	0955	1	20	2	6	4	11	6	2		–	26	7
19	23	51 44	02 57	17			2	2	1210	1	15	–	5	–	–	1	–	–	–	17	–
19	25	51 53	02 58	19			3	2	1620	1	17	–	7	5	3	3	–	–	–	23	–
19	26	51 56	02 32	23			3	2	1820	1	21	1	4	–	4	2	2	–	–	16	7
19	28	51 59	02 42	24	7·81	35·13	4	4	2315	1	22	–	2	1	4	7	–	–	–		
										2	22	–	–	2	4	7	2	–	–	7	4
										3	22	–	7	1	5	7	3	–	–		
20	29	52 02	03 18	18			4	4	0300	1	16	–	4	1	5	1	1	–	–	10	3
20	30	52 02	03 51	12			4	3	0620	1	10	–	–	–	1	1	–	–	–	–	–
20	31	52 07	03 07	19			5	4/5	1120	1	17	–	–	–	2	6	7	–	–	–	15
20	32	52 12	02 32	23			5	4	1415	1	21	2	2	3	3	2	3	–	–	9	7
20	34	52 19	02 23	24			4	4	1830	1	22	2	1	1	–	1	1	–	–	7	2
20	35	52 21	02 52	21	7·58	35·11	5	4/5	2055	1	19	2	6	2	9	6	7	–	–		
										2	19	1	6	5	6	5	6	–	–	13	11
										3	19	1	2	1	5	–	3	–	–		
22	36	52 26	03 23	17			3	3	1450	1	15	1	6	3	8	3	3	–	–	24	10
22	37	52 26	03 55	13			3	3	1715	1	11	1	–	–	1	–	1	–	–	4	4
22	38	52 29	04 27	10			3	3	1900	1	8	–	–	–	–	–	–	–	–	–	–
22	40	52 57	04 17	17			5	5	2320	1	15	–	–	1	–	–	–	–	–	–	–
23	41	52 54	03 42	15			4	4	0215	1	13	–	2	1	1	4	1	–	–	5	3
23	42	52 49	03 08	15	6·59	34·88	5	5	0510	1	13	–	–	2	–	2	2	–	–		
										2	13	–	1	1	–	1	1	–	–	1	3
										3	13	–	–	1	–	–	1	–	–		

'GEORGE BLIGH'. *Cruise C.* 1936. 8–12 *February*

Day	Station	Position N ° ′	Position E ° ′	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
8	2	50 32	00 41	24	8·1	35·16	5	4	1615	1, 3	19	–	–	–	–	–	–	–	–	–	–
										2	19	–	–	–	1	–	–	–	–		
8	3	50 25	00 54	23			5	4	1850	1	21	–	–	–	1	–	–	–	–	–	–
8	5	50 31	01 20	21			5	4	2240	1	19	–	–	–	–	–	1	–	–	–	2
9	8	50 48	01 16	17	7·59	35·17	4	4	0400	1	15	–	–	1	–	–	–	–	–	–	1
										2	15	–	–	–	–	1	1	–	–		
										3	15	–	–	–	–	2	–	–	–		
9	10	50 55	01 15	17			4	4	0720	1	15	–	–	–	–	–	1	–	–	–	3
9	15	51 12	01 42	22			3	3	1528	1	22	–	–	–	1	–	1	–	–	–	3
9	18	51 23	02 24	14			3	3	2125	1	12	–	–	1	–	–	–	1	–	–	–
9	19	51 33	02 11	24	7·61	35·05	3	3	2325	1	22	–	–	2	1	1	–	–	–	3	1
										2	22	1	–	1	2	2	1	–	–		
										3	22	–	2	–	–	1	–	–	–		
10	20	51 44	01 59	20			5	4/5	0135	1	18	1	–	1	2	–	–	–	–	2	–
10	21	51 41	02 16	22			5/6	5	0405	1	20	–	1	1	–	3	–	–	–	1	–
										2	20	–	–	1	–	1	–	–	–		
										3	20	1	–	2	–	1	–	–	–		
10	22	51 39	02 33	18			6	6	0550	1	16	–	1	1	–	–	–	–	–	2	–
10	23	51 44	02 57	17			6/7	6	1010	1	15	–	9	7	6	6	1	1	–	17	2
10	24	51 49	03 26	14			7	6	1420	1	12	–	–	–	–	1	–	–	–	–	–
11	25	51 53	02 58	20			4	4	1450	1	18	–	3	3	4	3	1	–	–	8	2
11	26	51 55	02 29	25			3	3	1735	1	23	–	–	–	3	1	1	–	–	–	3
11	28	51 59	02 41	24	6·82	35·07	3	3	1625	1	22	1	3	2	4	8	3	1	–	5	10
										2	22	–	1	1	5	5	4	–	–		
										3	22	–	–	1	1	–	2	–	–		
11	29	52 04	03 16	17			4/5	4	1300	1	15	–	3	–	3	2	4	–	–	8	10
10	30	52 02	03 51	13			6/7	5/6	1820	1	11	–	–	–	–	–	1	–	–	–	2
12	31	52 07	03 07	19			2	2	0555	1	17	–	1	–	1	–	–	–	–	3	–
12	32	52 12	02 33	25			3	3	0110	1	23	2	10	2	9	5	2	4	–	39	7
11	34	52 18	02 20	26			3	3	2345	1	24	–	–	–	1	–	–	–	–	–	–
12	35	52 23	02 52	23	6·82	35·22	3	3	0310	1	21	1	2	–	2	1	1	1	–	10	4
										2	21	–	3	1	–	3	2	–	–		
										3	21	1	2	2	2	3	1	–	–		
12	37	52 27	03 54	14			2	2	1020	1	12	–	–	–	–	1	–	–	–	–	–
12	41	52 54	03 43	17			3	3	1950	1	15	–	–	1	2	–	1	–	–	–	3
12	42	52 49	03 09	17	6·17	35·22	3	3	2020	1, 2	15	–	–	–	–	–	–	–	–	1	–
										3	15	–	1	–	–	–	–	1	–		

'GEORGE BLIGH'. *Cruise D.* 1936. 22–26 *February*

Day	Station	Position N ° ′	Position E ° ′	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
22	2	50 32	00 41	24	7·87	35·18	3	3	1445	1	22	–	–	1	–	–	–	–		–	–
										2	22	–	–	–	4	–	–	–			
										3	22	–	–	–	1	–	–	–			
22	3	50 25	00 56	17			3	3	1645	1	15	–	–	–	–	–	–	2		–	–
22	7	50 55	01 30	28			2	2	2305	1	26	–	–	–	–	–	–	–		–	–
23	8	50 48	01 16	18	7·83	35·17	3	3	0140	1	16	–	–	–	–	1	1	2		–	4
										2	16	–	–	–	–	1	3	1			
										3	16	–	–	–	–	–	–	1			
23	9	50 52	01 00	20			3	3	0325	1	18	–	–	–	–	–	1	–		–	3
23	10	50 55	01 15	18			3	3	0440	1	16	–	–	–	–	–	2	1		–	7
23	11	51 01	01 31	29			3	2	0700	1	27	–	–	–	–	–	–	1		–	–
23	13	51 05	01 36	21	7·13	34·82	3	3	0915	1	19	–	–	–	1	–	–	1		–	–
										2	19	–	–	–	–	–	–	–			
23	15	51 12	01 44	26			3	3	1220	1	24	–	–	–	1	–	–	1		–	–
23	17	51 23	01 59	23	7·17	34·84	3	3	1515	1	21	–	–	–	–	–	–	1		–	–
23	19	51 33	02 11	24	6·99	34·99	3	3	2050	1	22	–	–	–	–	–	–	–			
										2	22	–	–	–	–	–	–	2		1	–
										3	22	–	1	–	–	–	–	–			
24	21	51 41	02 17	23	6·90	34·99	1	1	0055	1	21	1	1	–	–	–	–	1		2	–
24	25	51 53	02 58	21			2	2	0815	1	19	–	–	–	1	–	–	–		–	–
24	27	51 59	02 05	19			2/1	1	1230	1	17	–	–	–	–	–	–	–		–	–
24	28	51 59	02 41	23	6·54	34·79	1/2	1	1450	1	21	–	–	–	–	–	–	–			
										2	21	–	1	–	–	–	–	–		5	–
										3	21	–	4	2	–	–	–	–			
24	31	52 07	03 07	18			2	2	2340	1	16		–	–	–	–	–	1		–	–
25	32	52 12	02 33	24			3/4	3	0220	1	22	–	3	1	–	–	–	–		10	–
25	34	52 19	02 20	27			4/5	4	0640	1	25	–	–	–	–	–	–	1		–	–
25	35	52 21	02 53	20	6·79	34·99	4/5	4	0950	1	18	–	1	–	–	–	–	1			
										2	18	–	1	2	–	–	–	1		2	–
										3	18	–	1	–	1	2	–	1			
25	36	52 26	03 23	16			4	4	1300	1	14	–	–	–	–	–	–	2		–	–
25	37	52 26	03 55	13			4	3	1535	1	11	–	–	–	–	–	–	1		–	–
26	42	52 51	03 08	21	6·61	35·13	2	2	0305	1	19	–	–	–	–	1	–	–			
										2	19	–	–	–	–	2	–	–		–	–
										3	19	–	–	–	–	1	–	3			
26	43	52 43	02 18	26			2	2	0700	1	24	–	1	–	–	–	–	–		3	–

'GEORGE BLIGH'. *Cruise B.* 1937. 16–20 *January*

Day	Station	Position N ° ′	Position E ° ′	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
16	1	50 40	00 23	18			4	4	0200	1, 2	16	–	–	–	–	–	–	–	–	–	–
16	2	50 32	00 40	23			4	4	0355	1	21	3	–	–	–	–	2	–	–	11	5
										2	21	4	2	2	3	2	2	–	–		
16	3	50 25	00 53	16			5	4	0555	1	14	–	1	1	4	3	2	–	–	6	6
										2	14	4	–	1	1	3	3	2	–		
16	4	50 17	01 15	14			5	4	0750	1	12	–	–	–	–	1	–	–	–	–	–
										2	12	–	–	–	–	–	–	–	–		
16	5	50 31	01 20	16			5	4	0935	1	14	–	–	–	–	–	2	2	–	–	2
										2	14	–	–	–	–	–	–	–	–		
16	6	50 47	01 28	25			5	4	1125	1	23	–	–	–	1	–	–	1	–	–	–
										2	23	–	–	–	–	1	–	4	–		
16	7	50 56	01 30	34			5	4	1235	1	32	1	–	–	–	1	–	2	–	2	2
										2	32	1	–	–	1	–	2	15			
16	8	50 48	01 15	16			4	4	1525	1	14	1	–	–	3	–	2	2	–	1	4
										2	14	–	–	–	–	1	1	1	–		
16	9	50 52	01 00	18			4	4	1730	1, 2	16	–	–	–	–	–	–	–	–	–	–
16	10	50 55	01 16	17			3	3	1855	1	15	–	–	–	–	–	–	–	–	–	3
										2	15	–	–	–	3	1	2	–	–		
16	11	51 02	01 28	27			3	3	2035	1	25	3	3	4	3	1	6	1	–	15	11
										2	25	3	–	2	–	1	1	–	–		
16	12	51 08	01 29	13			3	3	2145	1	11	–	1	1	1	–	1	–	–	2	2
										2	11	–	–	–	–	–	–	–	–		
16	13	51 05	01 39	19			3	3	2245	1	17	–	–	1	–	1	–	–	–	–	2
										2	17	–	–	–	–	–	1	2	–		
17	15	51 12	01 43	24			3	3	0115	1	22	3	1	–	1	1	1	2	–	7	2
										2	22	·	–	1	–	–	–		–		
17	16	51 20	01 36	12			3	3	0215	1, 2	10	–	–	–	–	–	–	–	–	–	–
17	17	51 24	01 59	20			3	3	0410	1	18	2	–	2	–	–	–	–	–	8	–
										2	18	–	3	3	1	–	–	6	–		
17	18	51 23	02 25	16			3	3	0535	1	14	–	–	–	–	–	–	–	–	3	–
										2	14	2	–	–	–	–	–	1	–		
17	19	51 34	02 10	21			3	3	0715	1	19	1	3	2	–	–	–	–	–	12	2
										2	19	1	2	2	1	–	1	–	–		
17	20	51 44	01 59	17			3	3	0905	1	15	–	–	–	–	–	–	–	–	–	–
17	21	51 40	02 16	22			3/4	4	1025	1	20	2	1	5	2	1	2	1	–	10	2
										2	20	3	2	4	2	2	–	–	–		
17	22	51 39	02 33	17			4	4	1155	1	15	4	–	7	9	1	–	–	–	10	–
17	23	51 45	02 58	19			4	4	1635	1	17	4	2	–	–	1	–	1	–	16	1
										2	17	4	3	5	1	–	1	–	–		
17	24	51 49	03 26	16			4	3	1830	1	14	11	9	3	7	–	1	–	–	28	1
										2	14	–	–	–	–	–	–	–	–		
17	25	51 53	02 57	20			5	4	2015	1	18	–	–	–	–	–	–	–	–	28	1
										2	18	13	11	11	11	2	1	–	–		
18	27	51 59	02 06	18			5/6	4/5	0020	1	16	–	–	–	–	1	–	1	–	–	1
										2	16	–	–	–	–	–	1	–	–		
18	28	52 00	02 42	21			3	3	1615	1	19	1	2	1	5	–	–	–	–	17	–
										2	19	4	3	2	3	–	–	–	–		
19	29	52 01	03 16	18			3	3	1835	1	16	5	4	3	9	3	2	2	–	30	7
										2	16	6	3	10	9	2	2	–	–		
19	30	52 02	03 52	13			3	3	2045	1	11	1	2	–	–	1	–	–	–	5	–
										2	11	–	–	–	–	–	–	–	–		
19	31	52 06	03 07	17			3	3	0000	1	15	2	2	5	12	4	1	–	–	20	2
										2	15	6	2	10	7	3	–	–	–		
20	32	52 10	02 32	22			4	4	0235	1	20	6	2	5	2	3	1	–	–	19	4
										2	20	3	4	2	4	1	2	·	·		
20	33	52 18	02 04	19			4	4	0505	1, 2	17	–	–	–	–	–	–	–	–	–	–
20	34	52 18	02 21	25			4	4	0635	1	23	–	–	–	–	1	–	–	–	–	–
20	35	52 22	02 53	22			4	3	0850	1	20	3	1	1	2	2	1	–	–	9	4
										2	20	2	1	3	2	2	2	–	–		
20	36	52 26	03 24	15			4	3	1120	1	13	–	2	3	4	1	4	3	–	11	8
										2	13	1	5	6	1	2	2	1	–		
20	37	52 27	03 52	15			4	3	1335	1	13	–	1	1	–	2	–	1	–	3	1
										2	13	1	–	3	2	–	1	–	–		
20	38	52 28	04 28	8			3	3	1615	1, 2	6	–	–	–	–	–	–	–	–	–	–
20	39	52 45	04 20	12			3	3	1755	1, 2	10	–	–	–	–	–	–	–	–	–	–
20	40	52 57	04 18	14			4	3	1955	1	12	1	–	1	–	–	1	–	–	1	1
										2	12	–	–	–	–	–	–	1	–		
20	41	52 56	03 45	13			5	4	2230	1	11	3	–	1	1	2	2	–	–	7	7
										2	11	3	–	3	–	1	4	–	–		

'GEORGE BLIGH'. *Cruise R.* 1937. 17–20 *December*

Day	Station	Position °N,	Position °E,	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
17	3	50 24	00 56	21			4	3/4	1435	1	19	1	2	–	–	–	–		–	7	–
17	4	50 17	01 13	14			4	3/4	1615	1	12	–	–	–	–	1	1		–	–	3
17	6	50 46	01 27	26			4	4	2150	1	24	1	2	1	1	2	–		–	7	–
17	7	50 56	01 27	30			4	4	2315	1	28	–	3	–	1	1	–		–	7	–
18	8	50 48	01 21	30			4/5	4	0105	1	28	–	2	–	–	1	–		–	5	–
18	9	50 51	01 01	17			5	3	0320	1	15	–	–	–	1	–	–		–	–	–
18	10	50 55	01 16	17			4/5	4	0540	1	15	–	–	–	–	–	–		1	–	–
18	11	51 02	01 25	16			4	3	0750	1	14	–	–	–	–	1	–		–	–	–
18	13	51 05	01 38	21			4	4	1020	1	19	–	–	–	–	2	–		–	–	–
18	17	51 22	02 00	18			3	4/3	1700	1	16	1	–	1	–	1	–		–	3	–
18	19	51 33	02 12	17			4	3/4	2100	1	15	3	4	1	5	4	–		–	18	–
19	20	51 44	01 59	19			4	4	0040	1	17	–	–	–	1	–	–		–	–	–
19	21	51 42	02 15	20½			4	4	0205	1	18	1	6	1	2	2	–		–	18	–
19	22	51 39	02 33	19			4	4	0325	1	17	–	3	1	3	2	–		–	8	–
19	26	51 55	02 34	22			3	3	1155	1	20	1	3	5	4	2	1		–	13	3
19	27	51 59	02 06	20			3	3	1410	1	18	–	–	1	–	1	–		–	–	–
19	28	52 00	02 44	18			3	3	1655	1	16	1	–	2	–	–	–		–	3	–
19	29	52 01	03 17	16			3	3	1925	1	14	–	1	–	1	–	–		–	3	
20	31	52 07	03 07	19			3	3	0105	1	17	–	–	–	–	1	–		–	–	–
20	35	52 21	02 52	25			3	3	0950	1	25	–	–	–	–	–	1		–	–	3
20	36	52 24	03 23	16			3	3	1215	1	14	–	–	1	–	1	–		–	–	–

'GEORGE BLIGH'. *Cruise A.* 1938. 7–11 *January*

Day	Station	Position °N,	Position °E,	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
7	1	50 38	00 23	19			5	4/5	0530	1	17	–	–	–	–	1	–		1	–	–
7	2	50 32	00 40	23			5	4/5	0710	1	21	3	1	5	4	2	–		–	8	–
7	3	50 23	00 57	19			5	4/5	0845	1	17	2	–	3	–	–	–		–	4	–
7	4	50 17	01 12	17			5	4/5	1025	1	15	–	–	–	–	–	–		1	–	–
7	10	50 55	01 16	16			5	4	2035	1	14	–	1	2	1	–	–		4	2	–
7	11	51 02	01 30	26			5	4	2245	1	24	2	–	–	–	1	–		1	5	–
8	13	51 05	01 35	25			5	4	0105	1	23	–	–	1	1	–	–		1	–	–
8	15	51 12	01 44	25			4	4	0330	1	23	–	–	–	3	1	–		1	–	–
8	17	51 21	01 58	22			4	4	0640	1	20	3	1	–	–	1	–		1	10	–
8	19	51 33	02 11	24			3	3	1010	1	22	4	–	2	1	1	–		–	13	–
8	21	51 41	02 15	21			3	3	1325	1	19	2	3	2	1	–	–		1	17	–
8	22	51 39	02 33	21			3	3	1455	1	19	1	1	–	–	–	–		–	7	–
8	23	51 44	03 00	17			3	3	1655	1	15	–	1	–	–	–	–		–	3	–
8	25	51 53	02 59	17			4	3	2035	1	15	7	2	2	4	–	–		–	25	–
8	26	51 55	02 34	21			4	3	2245	1	19	10	1	4	6	2	–		2	30	–
9	28	52 01	02 42	21			3	3	0330	1	19	7	2	5	8	3	1		–	30	3
9	29	52 01	03 17	17			3/4	3	0640	1	15	2	–	–	1	–	–		–	7	–
9	31	52 07	03 08	17			5/6	5	1505	1	15	1	2	2	3	4	–		1	6	–
9	32	52 12	02 32	23			5/6	5	1830	1	21	14	2	7	10	6	2		–	33	4
10	35	52 21	02 54	20			2	2	2155	1	18	2	5	–	2	–	–		–	23	–
11	36	52 25	03 20	14			2	2	0010	1	12	3	1	–	1	–	–		–	14	–
11	37	52 27	03 54	14			2	2	0225	1	12	1	1	1	1	–	–		–	7	–
11	38	52 29	04 26	9			2	2	0430	1	7	1	–	–	3	–	–		1	4	–
11	41	52 56	03 45	13			2/3	2/3	1050	1	11	–	–	–	–	2	–		–	–	–

'GEORGE BLIGH'. *Cruise B.* 1938. 22–27 *January*

Day	Station	Position N ° ′	Position E ° ′	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
22	2	50 29	00 40	26			2	2	0240	1	24	1	–	2	2	–	1		–	3	3
22	3	50 24	00 56	21			2	2	0410	1	19	–	–	1	1	–	–		–	–	–
22	4	50 17	01 12	17			2	2	0540	1	15	–	–	–	–	–	–		–	–	–
22	5	50 31	01 24	10			2	2	0725	1	8	–	–	–	1	–	–		–	–	–
22	6	50 46	01 26	27			3	2	1510	1	25	–	–	–	–	1	–		1	–	–
22	7	50 56	01 29	27			3	3	1605	1	25	–	–	–	–	–	1		–	–	3
22	9	50 51	01 03	17			3	2	1940	1	15	–	–	1	–	4	1		–	–	3
23	10	50 55	01 16	16			3	2	1024	1	14	1	–	–	2	3	3		–	3	10
23	11	51 02	01 29	28			2	2	1220	1	26	2	–	–	3	2	2		1	6	6
23	12	51 07	01 31	28			3	2	1310	1	26	–	–	–	–	1	–		–	–	–
23	13	51 05	01 39	21			3	2	1400	1	19	–	–	–	–	3	–		1	–	–
23	15	51 12	01 42	23			2	2	1615	1	21	1	–	–	1	1	1		2	3	3
23	17	51 23	02 01	22			2	2	1905	1	20	5	–	5	2	3	2		1	16	7
23	19	51 33	02 11	21			3	3	2200	1	19	3	1	3	2	3	–		5	13	–
23	20	51 44	01 59	18			3	3	2345	1	16	–	–	–	–	1	–		2	–	–
24	21	51 42	02 15	22			3	3	0105	1	20	12	2	3	9	7	1		1	46	3
24	22	51 39	02 33	20			4	4	0230	1	18	7	4	4	5	–	–		–	28	–
24	23	51 44	03 00	20			4	4	0435	1	18	11	1	2	2	2	–		–	30	–
24	25	51 53	02 59	19			4	4	0855	1	17	10	2	10	7	5	1		–	30	3
24	26	51 57	02 36	26			4	4	1135	1	24	3	–	5	2	–	1		–	7	2
24	27	51 59	02 06	18			4/3	3	1340	1	16	–	–	–	–	–	–		3	–	–
24	28	52 00	02 41	25			3	3	1615	1	23	15	6	13	6	4	–		1	68	–
24	29	52 01	03 17	16			4	4	1730	1	14	10	5	16	15	7	–		–	39	–
24	30	52 02	03 52	13			4	4	2055	1	11	–	–	–	–	1	–		–	–	–
25	31	52 07	03 07	18			5	5	0045	1	16	6	3	2	1	4	–		–	19	–
25	32	52 12	02 32	23			5	5	0345	1	21	10	1	–	2	–	–		1	23	–
26	35	52 23	02 52	22			4	5	1620	1	20	5	4	4	–	9	2		–	21	5
26	36	52 26	03 22	20			4	5	1835	1	18	5	2	4	3	6	2		8	16	5
26	37	52 28	03 55	12½			4	5	2040	1	10½	6	–	–	2	1	–		–	15	–
27	41	52 54	03 43	14			4	4	0525	1	12	–	–	3	1	1	3		5	–	8
27	42	52 48	03 09	19			5	5	0830	1	17	2	1	–	3	4	–		1	6	–

'GEORGE BLIGH'. *Cruise D.* 1938. 23–26 *February*

Day	Station	Position N ° ′	Position E ° ′	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
23	2	50 31	00 40	21			3	3	0635	1	19	–	–	–	1	–	–	–	–	–	–
23	7	50 56	01 30	33			3	3	1630	1	31	–	–	–	–	–	–	–	1	–	–
23	10	50 55	01 16	16			3	3	2105	1	14	–	–	–	–	1	–	–	–	–	–
24	12	51 08	01 29	15			3	3	0005	1	13	–	–	–	–	–	–	–	1	–	–
24	13	51 05	01 35	21			3	3	0100	1	19	–	–	–	–	2	1	–	–	–	3
24	17	51 23	02 00	21			3	3	0646	1	19	–	–	1	–	1	3	1	–	–	10
24	18	51 22	02 24	18			2	2	0840	1	16	–	–	–	–	–	–	1	–	–	–
24	20	51 47	02 02	18			2	2	1220	1	16	–	–	–	1	–	–	–	–	–	–
24	22	51 39	02 33	20			2	2	1500	1	18	–	–	–	–	–	–	1	–	–	–
24	23	51 44	03 00	17			2	2	1715	1	15	–	–	–	–	–	1	–	–	–	3
24	25	51 53	02 59	17			2	2	2130	1	15	1	–	4	7	8	4	2	–	3	14
24	26	51 56	02 35	22			2	2	2335	1	20	–	–	–	–	2	–	–	–	–	–
25	28	52 00	02 42	19			2	2	0450	1	17	–	–	–	–	1	5	1	–	–	17
25	29	52 01	03 16	15			2	2	0735	1	13	1	–	2	3	1	3	9	–	3	10
25	31	52 07	03 07	16			3	3	1420	1	14	–	–	–	–	1	–	1	–	–	–
25	32	52 11	02 35	22			3	3	1710	1	20	3	2	7	7	2	5	1	–	16	16
25	35	52 23	02 52	22			3	3	2355	1	20	4	–	1	4	2	1	1	–	13	3
26	36	52 25	03 24	19			3	3	0225	1	17	–	–	–	1	1	4	1	–	–	13
26	37	52 28	03 54	10			3	3	0500	1	8	1	–	–	–	–	–	–	–	4	–
26	40	52 57	04 21	13			3	3	1120	1	11	–	–	1	–	–	–	–	–	–	–
26	41	52 54	03 43	16			3	3	1430	1	14	–	–	–	1	–	–	1	–	–	–
26	42	52 49	03 09	16			3	3	1730	1	14	1	–	2	–	–	5	–	–	3	17

'GEORGE BLIGH'. *Cruise R.* 1938. 16–17 *December*

Day	Station	Position N ° ′	Position E ° ′	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
16	8	50 31	00 39	22	12·07	35·29	4	4	1130	1	20	–	–	1	–	–	–	–	–	–	–
16	9	50 22	00 51	19	11·86	35·39	3	4	1330	1	17	1	1	1	1	–	–	–	–	5	–
16	10	50 14	01 05	15	10·54	34·44	3	4	1515	1	13	–	–	–	–	1	1	–	–	–	3
16	13	50 56	01 30	32	11·92	35·28	3	3	2005	1	30	–	–	–	–	2	–	–	–	–	–
17	19	51 05	01 38	19	11·76	35·28	3	3	0610	1	17	1	–	–	–	1	1	–	–	3	3
17	23	51 21	01 58	22	11·69	35·31	3/4	4	1155	1	20	1	–	–	–	–	1	–	–	2	2
17	24	51 23	02 25	12	11·10	35·09	4/5	5	1445	1	10	1	–	–	1	–	–	–	–	2	–
17	25	51 33	02 11	21	11·49	35·24	4/5	6	1630	1	19	1	2	3	–	1	–	1	–	6	–

'GEORGE BLIGH'. *Cruise A.* 1939. 6–12 *January*

Day	Station	Position N ° ′	Position E ° ′	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
6	2	50 31	00 39	22	8·98	35·33	3/2	2	0120	1	20	4	2	–	–	2	–	–	–	20	–
6	3	50 22	00 55	26	8·36	35·23	2	2	0310	1	24	–	–	1	–	2	–	–	–	–	–
6	5	50 31	01 16	13	7·45	35·06	2	2	0655	1	11	–	–	–	–	–	1	–	1	–	4
6	9	50 51	01 01	19	8·38	35·29	2	2	1500	1	17	–	–	–	–	2	1	–	–	–	3
6	10	50 55	01 16	17	8·30	35·30	1	1	1635	1	15	–	–	–	3	1	1	–	–	–	3
6	13	51 04	01 37	20	8·04	35·14	2	2	2120	1	18	1	–	–	1	–	–	–	–	3	–
6	15	51 12	01 42	24	7·54	35·20	2	2	2340	1	22	1	–	–	–	–	–	–	–	3	–
7	17	51 21	01 59	21	7·98	35·20	3	2	0240	1	19	3	1	–	2	–	–	–	–	13	–
7	19	51 33	02 12	20	7·88	35·20	3/4	3	0625	1	18	11	1	5	2	–	–	–	–	40	–
7	21	51 42	02 15	22	7·98	35·28	6	5	1020	1	20	3	2	2	2	2	3	2	–	10	6
10	23	51 56	02 32	22	7·98	35·28	2	2	1455	1	20	2	–	3	6	3	3	3	–	7	10
10	24	51 39	02 33	24	7·25	35·08	2	2	1720	1	22	2	1	–	–	–	–	–	–	10	–
10	25	51 45	03 01	16½	6·51	34·95	2	2	1940	1	14½	2	–	–	–	–	–	–	–	7	–
10	26	51 53	02 59	17	7·07	35·11	2	2	2050	1	15	6	2	1	–	–	–	1	–	27	–
10	27	51 49	03 27	17	3·69	33·53	2	2	2335	1	15	–	1	–	–	–	–	–	–	3	–
11	29	52 07	03 07	18	7·11	35·16	3	3	0600	1	16	13	1	6	8	4	–	1	–	47	–
11	30	52 12	02 32	25	–	35·33	4	4	0850	1	23	7	2	1	5	–	2	–	–	22	5
11	32	52 23	02 52	24	8·08	35·28	5/6	5	1515	1	22	6	1	4	10	8	3	2	–	14	6
11	33	52 25	03 22	17	7·14	35·23	5/6	5	1755	1	15	–	2	–	3	3	4	–	–	4	9
12	36	52 54	03 43	15	7·19	35·26	4	4	0255	1	13	2	–	3	–	1	–	–	–	5	–
12	37	52 49	03 09	17	7·53	35·11	3	2	0545	1	15	1	–	–	1	–	–	–	–	3	–

'GEORGE BLIGH'. *Cruise B.* 1939. 21–25 *January*

Day	Station	Position N ° ′	Position E ° ′	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
21	8	52 48	03 09	19	7·98	35·23	4	4	0055	1	17	4	–	1	4	5	5	2	–	10	13
21	9	52 55	03 43	16	7·30	35·21	4	4	0340	1	14	2	–	2	–	2	5	3	–	5	13
21	11	52 43	04 21	13	5·73	34·94	3	3	0820	1	11	–	–	1	–	–	1	–	–	–	4
21	13	52 28	03 52	15	6·62	35·01	3	2	1300	1	13	–	–	1	1	8	2	–	–	–	7
21	14	52 25	03 24	20	7·09	35·12	3	3	1510	1	18	–	–	1	3	1	–	1	–	–	–
21	15	52 23	02 53	21	7·90	35·21	3	3	1740	1	19	1	1	1	1	5	2	1	–	7	7
22	17	52 12	02 32	24	8·39	35·25	2	2	2335	1	22	5	–	1	4	5	–	–	–	16	–
22	18	52 07	03 07	19	7·19	34·91	3	3	0235	1	17	4	7	2	8	12	1	–	–	37	3
22	19	52 02	03 52	14	4·24	33·58	2	2	0520	1	12	1	–	–	–	–	–	–	–	4	–
22	20	52 03	03 15	15	5·97	34·60	4	3	0825	1	13	2	1	1	3	–	1	–	–	8	3
22	21	52 00	02 41	23	8·31	35·23	4/5	3/4	1120	1	21	7	–	3	6	1	–	3	–	17	–
22	22	52 00	02 06	20	8·81	35·21	4/5	4	1430	1	18	–	–	–	–	–	–	1	–	–	–
22	23	51 56	02 33	23	8·45	35·28	5/6	4/6	1645	1	21	4	1	1	1	–	–	1	–	10	–
22	24	51 41	02 16	25	8·88	35·28	6	5	2130	1	23	6	1	5	3	4	1	4	–	13	2
22	25	51 44	01 59	21	–	–	6	5	2345	1	19	–	–	1	2	1	4	–	–	–	8
23	27	51 13	01 38	21	9·08	35·17	6	5	1240	1	19	1	–	1	3	3	4	–	–	2	8
24	29	51 05	01 37	20	9·09	35·30	2	2	2120	1	18	–	–	–	–	–	1	–	–	–	3
25	30	51 21	01 58	23	8·92	35·30	2	2	0115	1	21	1	–	1	–	1	–	–	–	3	–
25	31	51 23	02 24	17	8·21	35·11	2	2	0225	1	15	2	–	–	1	1	–	–	–	7	–
25	32	51 33	02 11	22	8·78	35·29	2	2	0450	1	20	4	1	1	1	1	–	–	–	16	–
25	33	51 39	02 33	21	8·41	35·27	3	3	0620	1	19	6	5	4	1	–	–	1	–	36	–
25	34	51 44	02 57	20	7·29	34·87	3	3	0835	1	18	6	1	4	6	1	–	–	–	23	–
25	36	51 53	02 59	17	7·53	35·03	4	3/4	1320	1	15	12	5	8	15	4	–	–	–	43	–

'GEORGE BLIGH'. *Cruise C.* 1939. 2–4 *February*

Day	Station	Position °N	Position °E	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
2	2	52 50	03 11	16	6·69	35·22	3	3	0210	1	14	1	1	2	1	2	1	1	–	7	3
2	3	52 57	03 43	20	6·04	35·22	2	2	0455	1	18	3	–	–	1	–	1	3	–	10	3
2	7	52 27	03 55	18	5·21	34·53	3	3	1400	1	16	1	–	–	–	–	1	1	–	3	3
2	8	52 26	03 22	19	5·91	34·86	3	3	1620	1	17	2	1	2	1	3	6	6	–	10	20
2	9	52 22	02 50	21	7·34	35·26	2/3	3	1855	1	19	1	1	–	–	2	1	–	–	7	3
2	10	52 16	02 00	22	4·49	34·23	2	2	2240	1	20	–	–	–	–	–	–	1	–	–	–
3	11	52 12	02 32	26	7·42	35·24	2	2	0125	1	24	4	2	2	7	4	3	–	–	20	10
3	12	52 07	03 07	20	6·61	35·17	2	2	0405	1	18	3	–	–	5	5	1	2	–	10	3
3	14	52 04	03 54	15	4·69	33·17	2	2	0810	1	13	–	–	–	–	1	–	–	–	–	–
3	15	52 01	03 17	16	5·69	34·28	2	2	1605	1	14	–	1	–	1	2	3	–	–	3	10
3	16	52 01	02 42	26	7·36	35·28	2	2	1850	1	24	1	4	1	2	4	–	–	–	16	–
3	17	51 59	02 06	21	6·80	35·07	2	2	2200	1	19	–	–	1	–	–	–	–	–	–	–
4	18	51 56	02 32	24	7·48	35·29	2	2	0010	1	22	2	–	1	3	–	2	–	–	7	7
4	19	51 52	02 57	19	6·36	35·14	2	2	0220	1	17	3	1	–	3	4	10	1	–	13	34
4	20	51 50	03 25	18	5·09	32·84	2	2	0415	1	16	–	–	1	–	–	3	6	–	–	10
4	21	51 44	03 00	19	6·21	35·04	2	2	0630	1	17	2	4	4	6	12	10	–	–	20	34
4	22	51 39	02 33	22	6·99	35·21	2	2	0925	1	20	2	–	1	4	–	–	–	–	7	–
4	23	51 41	02 15	24	7·63	35·33	3	3	1110	1	22	2	1	–	5	–	4	8	–	10	13
4	24	51 44	01 59	20	7·56	35·21	3	3	1300	1	18	–	–	–	1	2	–	–	–	–	–
4	25	51 33	02 10	26	7·68	35·32	3	3	1415	1	24	–	1	1	–	1	2	–	–	3	6
4	26	51 22	02 24	17	6·19	34·65	3	3	1705	1	15	1	–	–	–	–	–	–	–	3	–
4	27	51 21	02 00	23	7·78	35·29	3	3	1915	1	21	2	–	–	5	2	–	4		7	–

'GEORGE BLIGH'. *Cruise D.* 1939. 15–18 *February*

Day	Station	Position °N	Position °E	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
15	1	52 43	02 19	26	4·79	34·33	2	2	2210	1	24	–	–	–	–	–	–	–	–	–	–
16	2	52 49	03 09	17	6·71	35·28	3	3	0150	1	15	2	5	–	4	3	1	5	1	24	3
16	3	52 54	03 43	16	6·35	35·23	3	3	0420	1	14	1	–	1	–	–	1	1	–	3	3
16	4	52 58	04 18	16	5·19	34·60	3	3	0645	1	14	–	–	–	–	1	–	1	–	–	–
16	5	52 43	04 24	10	4·54	30·40	3	3	0840	1	8	–	–	–	–	–	–	–	–	–	–
16	6	52 28	04 28	8	4·54	27·86	3	3	1045	1	6	–	–	–	–	–	–	–	–	–	–
16	7	52 27	03 55	14	5·24	34·23	3	3	1335	1	12	–	–	–	–	–	–	–	–	–	–
16	8	52 26	03 22	18	6·61	35·22	3	3	1635	1	16	–	–	–	2	5	6	1	–	–	20
16	9	52 23	02 52	25	7·38	35·36	2	2	1915	1	23	–	–	1	2	4	3	–	–	–	10
16	10	52 19	02 00	19½	4·68	34·05	2	2	2335	1	17½	–	–	–	–	1	–	–	–	–	–
17	11	52 12	02 32	23	7·50	35·30	2	2	0210	1	21	2	1	3	4	5	4	1	–	10	13
17	12	52 08	03 04	20	6·71	35·22	2	2	0440	1	18	3	1	2	2	3	3	10	–	13	10
17	13	52 05	03 29	17	6·11	34·95	2	2	0640	1	15	1	–	–	3	3	4	29	–	3	14
17	14	52 02	03 52	12	5·28	33·08	2	2	0900	1	10	–	–	–	–	–	–	7	–	–	–
17	15	52 02	03 17	18	5·97	34·88	3	3	1200	1	16	2	–	–	2	7	9	9	–	7	30
17	16	52 00	02 42	22	7·19	35·28	3	3	1500	1	20	2	–	2	1	2	–	2	–	7	–
17	17	51 59	02 06	18	6·79	35·10	4	3/4	1815	1	16	–	–	–	–	–	–	–	–	–	–
17	18	51 57	02 33	22	7·38	35·31	4	4	2045	1	20	–	–	–	–	1	2	–	1	–	5
17	19	51 53	02 59	20	6·40	35·06	5	4	2300	1	18	–	–	–	–	–	1	11	–	–	2
18	20	51 49	03 25	16	5·19	33·78	5	4	0125	1	14	–	–	–	–	2	–	–	–	–	–
18	21	51 34	03 00	17	5·88	34·74	5	5	0445	1	15	–	–	–	1	1	1	3	–	–	2
18	22	51 39	02 33	21	6·70	35·09	5	4/5	0800	1	19	–	–	–	–	–	–	–	–	–	–
18	23	51 41	02 15	22	7·32	35·20	5/4	5	0955	1	20	–	–	–	–	–	–	–	–	–	–
18	24	51 44	01 59	19	6·87	35·03	4	4	1155	1	17	–	–	–	–	–	–	–	–	–	–
18	25	51 35	02 13	27	7·47	35·37	3	3	1350	1	25	1	–	–	–	1	1	1	–	3	3
18	26	51 23	02 24	19	5·99	34·30	3	3	1535	1	17	–	–	–	–	–	–	–	–	–	–
18	27	51 21	02 00	21	7·40	35·18	3	3	1740	1	19	–	–	–	–	–	–	–	–	–	–
18	28	51 20	01 36	11	6·29	34·41	2	2	1915	1	9	–	–	–	–	–	–	–	–	–	–
18	29	51 12	01 42	23	7·07	34·90	2	2	2030	1	21	–	–	–	–	–	–	–	–	–	–
18	30	51 08	01 29	19	6·49	34·32	2	2	2135	1	17	–	–	–	–	–	–	–	–	–	–
18	31	51 04	01 36	22	7·37	35·10	2	2	2230	1	20	–	–	–	–	–	–	–	2	–	–
18	32	51 00	01 45	17	6·11	34·17	2	2	2335	1	15	–	–	–	–	–	–	–	–	–	–

'SIR LANCELOT'. *Cruise* 2. 1946. 26–31 *December*

Day	Station	Position °N,	Position °E,	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
26	1	52 30	03 23	19	7·26	35·21	4/5	4	1740	1	17	1	–	–	–	–	–	–	–	5	–
										2	17	–	3	–	1	–	–	–	–		
27	2	51 50	02 44	22½	7·45	35·16	3	4	0700	1	21	12	2	–	2	–	–	–	–	38	–
										2	21	13	2	–	5	2	–	–	–		
27	3	51 40	02 29	19	7·99	35·16	3	3	0915	1	17	5	1	–	2	2	–	–	3	12	3
										2	17	1	–	–	1	1	2	–	1		
27	4	51 19	01 52½	22	8·11	35·12	3	2	1320	1	19½	3	–	1	–	1	2	–	–	12	3
										2	19½	3	1	1	3	1	–	–	–		
27	5	51 11½	01 44	16–22	8·01	35·07	2	½	1517	1	22	3	–	–	4	–	2	–	–	6	3
										2	22	2	–	–	3	2	–	1	–		
27	6	50 38	00 14 W	22	8·48	35·04	3	3	2328	1, 2	20	–	–	–	–	–	–	–	–	–	–
28	7	50 36	00 40½	12	8·55	35·07	4	2/3	0405	1, 2	9	–	–	–	–	–	–	–	–	–	–
28	8	50 27	01 17	18	7·03	34·50	4	3	0650	1, 2	15	–	–	–	–	–	–	–	–	–	–
28	9	50 11	01 17	49–50	9·70	35·17	3	3	0850	1, 2	47	–	–	–	–	–	–	–	–	–	–
28	10	50 01	01 16	42	10·21	35·22	3	3	1100	1, 2	39	–	–	–	–	–	–	–	–	–	–
28	11	50 01	00 54	33	10·00	35·23	4	3	1305	1, 2	31	–	–	–	–	–	–	–	–	–	–
28	12	50 10	00 48	31–27	9·59	35·19	4	4	1510	1, 2	29	–	–	–	–	–	–	–	–	–	–
28	13	50 23	00 42	27	8·97	35·08	4	4	1710	1, 2	25	–	–	–	–	–	–	–	–	–	–
28	14	50 26	00 22	26	9·40	35·28	4	4	1937	1, 2	18	–	–	–	–	–	–	–	–	–	–
28	15	50 11	00 17	26	9·56	35·26	4	4	2140	1, 2	19	–	–	–	–	–	–	–	–	–	–
28	16	49 55	00 12 E	26	9·04	35·26	4	4	2345	1	23½	1	1	1	2	1	–	–	–	2	–
										2	23½	–	–	–	2	–	–	–	–		
29	17	50 13	00 07	25	9·53	35·28	3	3	0242	1, 2	23	–	–	–	–	–	–	–	–	–	–
29	18	50 27	00 08	30	9·30	35·29	3	3	0500	1	28	1	–	–	–	–	–	–	–	2	–
										2	28	–	–	–	–	–	–	–	1		
29	19	50 31	00 36	28	9·16	35·30	2	2	0933	1	26	3	2	3	10	–	1	–	–	23	5
										2	26	5	4	4	5	1	2	–	–		
29	20	50 17	00 45	21	8·74	35·31	2	2	1130	1	20	5	–	1	1	–	–	–	–	14	–
										2	20	4	–	–	–	–	–	–	–		
29	21	50 35	00 57	21	8·77	35·28	1	2	1347	1	20½	5	5	4	8	1	2	–	–	17	3
										2	20½	1	–	3	2	1	–	–	–		
29	22	50 49	01 08	19–22	8·76	35·37	1	0	1520	1	18	–	–	–	–	2	–	–	–	–	–
										2	18	–	–	–	2	–	–	–	–		
29	23	51 10	01 41½	19	7·77	35·01	1	–	1830	1	16	2	1	–	1	–	–	–	–	7	–
										2	16	–	1	–	–	–	–	–			
29	24	51 19½	01 52	21	7·93	35·06	2	2	1758	1	19	1	1	3	1	–	1	–	–	12	2
										2	19	4	1	–	–	1	–	–	–		
29	25	51 44	02 06½	30–31	8·07	35·12	3	2	2315	1	29	1	–	2	2	1	1	–	–	3	2
										2	29	–	1	1	2	3	–	–	1		
30	26	51 51	02 14	22–26	8·51	35·19	3	3	0110	1	23	5	3	3	1	2	1	–	1	29	2
										2	19	8	1	1	4	2	–	–	–		
30	27	52 00	02 27	21	8·17	35·17	4	4	0312	1	18½	9	3	1	3	–	1	–	1	31	1
										2	18½	7	5	3	2	–	–	–	1		
30	28	51 50	02 45½	17–19½	7·26	35·17	4	4	0508	1	18½	26	6	10	4	1	1	–	1	69	1
										2	15½	20	5	8	2	1	–	–	–		
30	29	51 45	02 50	18	6·59	35·14	4	4	0640	1	16	7	3	–	1	–	1	–	1	24	1
										2	16	6	3	2	1	–	–	–	–		
30	30	51 51	03 13	15½	6·06	35·00	4	4	0814	1	14	3	–	–	1	–	1	–	–	6	2
										2	14	2	–	–	1	1	1	–	–		
30	31	52 00	03 00	16	7·18	35·20	4	4	0952	1	13	9	4	3	5	3	–	–	–	21	3
										2	13	1	1	8	10	3	2	–	–		
30	32	52 08	02 43	25–29	7·97	35·22	4	4	1140	1	23	14	2	13	14	12	–	–	2	35	–
										2	23½	6	5	4	12	6	–	–	–		
30	33	52 15	02 27	23	7·98	35·03	3	3	1330	1, 2	20	–	–	–	–	–	–	–	–	–	–
30	34	52 23	02 35	25	8·06	35·02	3	3	1450	1	22	–	–	–	–	–	–	–	–	3	–
										2	22	2	–	–	–	–	–	–	–		
30	35	52 17	02 51	22	7·89	35·25	3	3	1630	1	18	3	1	–	3	2	1	–	–	16	4
										2	18	3	2	2	5	–	1	–	–		
30	36	52 10	03 07	18	7·03	35·25	2/3	3	1826	1	15	3	2	5	5	–	5	–	–	18	13
										2	15	2	3	5	6	3	2	–	1		
30	37	52 02	03 25	16½	6·18	35·05	3/4	3	2108	1	15	1	1	–	1	–	–	–	–	5	–
										2	15	–	1	1	1	–	–	–	–		
30	38	52 09	03 39	15	5·79	34·77	3	3	2153	1, 2	12	–	–	–	–	–	–	–	–	–	–
30	39	52 16	03 23	18½	6·49	35·12	2	3	2349	1	15½	–	–	1	1	–	–	–	–	4	–
										2	15½	2	–	1	1	1	–	–	–		
31	40	52 24	03 08	21	7·28	35·22	2	2	0133	1	18	1	–	1	4	3	–	–	–	4	–
										2	18	–	1	–	2	–	–	–	–		
31	41	52 31½	02 52	25	8·08	35·25	3	3	0323	1	22	7	–	1	2	2	–	–	–	17	–
										2	22	3	–	1	1	2	–	–	1		
31	42	52 45	03 09	19	7·82	35·25	3	3	0550	1	16	3	2	–	4	–	1	–	–	25	4
										2	16	6	3	2	2	–	1	–	–		
31	43	52 50	02 51	19	7·91	35·09	4/5	4	0728	1	16	4	–	1	–	–	–	–	–	9	–
										2	16	3	–	–	–	–	–	–	–		
31	44	52 43½	02 18	27	6·12	34·05	4	4	1109	1, 2	25	–	–	–	–	–	–	–	–	–	–

'PLATESSA'. *Cruise* 1. 1947. 9–12 *January*

Day	Station	Position °N ′	Position °E ′	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
9	1	51 02	01 32	30	8·75	35·31	4/5	5	1109	1	28	13	8	6	–	–	–	–	–	34	–
										2	28	6	7	4	–	–	–	–	–		
10	2	51 19	01 52½	23½	8·62	35·32	2/3	3	1555	1	20	1	–	2	–	–	–	–	–	21	–
										2	20	9	2	7	1	1	–	–	–		
10	3	51 11	01 42	25	8·70	35·28	3	4	1800	1	23	8	–	3	–	–	–	–	–	25	–
										2	23	9	2	14	3	–	–	–	–		
11	4	50 43½	01 03	16	9·00	34·96	2		0810	1	15	9	–	1	–	–	–	–	–	30	–
										2	15	7	3	1	–	–	–	–	–		
11	5	50 42½	01 21	17	8·69	35·29	3	1	0942	1	15	1	–	2	–	–	–	–	–	2	2
										2	15	–	–	3	–	–	1	–	–		
11	6	50 28	01 15	14	8·61	35·17	3	2	1205	1	13	–	1	3	1	–	–	–	–	2	–
										2	13	–	–	2	2	–	–	–	–		
11	7	50 15½	01 01	21	8·70	35·25	3	2	1422	1	20	1	–	2	1	–	–	–	–	3	–
										2	20	–	1	–	–	–	–	–	–		
11	8	50 28½	00 51½	24	9·18	35·21	4/5	4	1619	1	23	5	–	–	–	–	–	–	–	11	–
										2	23	3	1	1	1	–	–	–	1		
11	9	50 41½	00 42	21	8·06	34·94	4/5	4/5	1808	1, 2	19	–	–	–	–	–	–	–	–	–	–
12	10	50 37	00 26½	31	8·50	35·05	2/3	4	0140	1, 2	30	–	–	–	–	–	–	–	–	–	–
12	11	50 23½	00 31½	25	9·40	34·94	3	4	0349	1	23	–	1	–	–	–	–	–	–	3	–
										2	23	1	–	–	–	–	–	–	–		
12	12	50 12	00 35½	23	9·31	34·98	5	4/5	0530	1	21	–	–	–	–	–	–	–	–	1	–
										2	21	1	–	–	–	–	–	–	–		

'SIR LANCELOT'. *Cruise* 1. 1947. 9–12 *January*

Day	Station	Position °N ′	Position °E ′	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
9	1	51 54	02 13	29½	8·17	35·35	3	2	1832	1	27	5	4	5	7	9	1	1	1	21	7
										2	27	2	2	3	4	6	3	–	2		
9	2	51 41	02 00	19–20½	8·58	35·35	3	2	2042	1	18½	3	3	2	10	1	–	–	1	13	3
										2	18½	–	2	1	5	2	2	–	–		
9	3	51 41	02 29	20	7·30	35·26	3	2	2307	1	18	8	7	–	–	–	–	1	1	60	–
										2	18	11	10	9	–	2	–	–	2		
10	4	51 40	02 53	18½–21½	5·58	34·87	2	2	0104	1	16	9	1	–	–	–	–	–	1	28	–
										2	16	4	1	4	1	–	–	–	–		
10	5	51 51	02 44	18½–21	6·36	35·08	2	2	0236	1	18	13	7	4	4	1	1	–	–	64	3
										2	18	14	5	6	5	1	1	–	–		
10	6	52 00	02 27	26	7·54	35·30	2	2	0443	1	24½	3	3	7	4	1	–	1	–	35	–
										2	24½	9	7	9	8	–	–	–	1		
10	7	52 08	02 14	23½	7·49	35·26	2	2	0614	1	21½	–	–	–	–	–	–	–	1	–	2
										2	21½	–	–	–	1	–	1	–	–		
10	8	52 15	02 27	22½	7·47	35·28	2	2	0726	1	22	–	–	–	4	2	–	–	–	–	–
										2	22	–	–	–	3	1	–	–	–		
10	9	52 08	02 46	22½	7·09	35·19	2	2	0853	1	21½	11	3	8	5	–	2	–	.	49	10
										2	21½	9	8	3	7	6	4	–	2		
10	10	52 00	03 00	18½	6·78	35·12	2	2	1057	1	16½	12	6	16	6	–	1	–	2	44	5
										2	16½	5	3	5	7	1	2	–	–		
10	11	51 51	03 13	17½	5·25	34·99	2	2	1230	1	15½	9	–	4	1	–	–	–	–	29	2
										2	15½	7	1	5	1	–	1	–	–		
10	12	52 02	03 25	17½	5·36	35·17	3	2	1409	1	15½	1	5	5	17	6	3	–	1	15	5
										2	15½	2	1	3	5	3	–	–	–		
10	13	52 10	03 07	20	6·37	35·19	3	2	1548	1	18	2	2	4	9	3	–	–	–	20	–
										2	18	3	5	8	19	4	–	–	1		
10	14	52 17	02 51	18½–20½	7·20	35·25	3	2	1724	1	20	2	6	3	6	4	3	–	–	22	9
										2	20	5	2	6	9	8	3	1	–		
10	15	52 24	02 35	25	7·19	35·16	3	2	1857	1	23	–	–	–	–	–	–	–	–	3	–
										2	23	1	1	1	–	–	–	–	–		
10	16	52 43	02 18	27½	5·43	34·34	3	3	2104	1, 2	25½	–	–	–	–	–	–	–	–	–	–
10	17	52 37	02 33	28½	6·66	35·07	4	4	2224	1, 2	26½	–	–	–	–	–	–	–	–	–	–
10	18	52 30	02 50	23	7·50	35·25	4/5	4	2351	1	21	4	2	2	10	3	–	–	1	11	1
										2	21	2	1	2	7	2	1	–	–		
11	19	52 23	03 06	17	7·09	35·25	5	5	0127	1	15	1	3	4	5	8	1	1	2	10	6
										2	15	1	4	7	4	4	5	1	1		
11	20	52 16	03 23	17½	5·92	35·25	5	5	0308	1	15½	–	6	7	7	5	3	1	1	10	16
										2	15½	1	2	12	22	8	12	–	–		
11	21	52 09	03 39	14½	5·07	35·24	5	5	0458	1	12½	–	2	4	3	1	2	1	1	3	2
										2	12½	1	–	7	7	1	–	–	–		
11	22	52 20	03 48	14	5·79	35·28	5	5	0606	1	12	–	1	–	1	–	–	–	–	1	1
										2	12	–	–	–	2	2	1	2	–		
11	23	52 30	03 22	19	6·35	35·29	5	5	0818	1	17	1	1	2	9	1	4	2	–	7	6
										2	17	2	3	2	7	5	2	–	1		
11	24	52 37	03 05	19	7·25	35·25	5	5	0948	1	17	1	2	1	16	5	1	–	–	10	3
										2	17	2	4	7	16	2	2	1	2		
11	25	52 44	02 48	19½	7·09	35·18	5	5	1145	1	17½	1	–	–	–	–	–	–	–	3	–
										2	17½	2	–	–	–	–	–	–	–		
11	26	52 56	02 58	15	6·55	35·07	5	5	1344	1	13	1	–	–	–	–	–	–	–	2	–
										2	13	–	1	–	1	–	–	–	–		
11	27	52 49	03 14	14½	7·00	35·23	5	5	1600	1	12½	2	–	2	8	2	2	–	1	7	3
										2	12½	3	1	2	6	3	1	–	1		
11	28	52 41	03 32	15	6·12	35·29	5	5	1906	1	13	–	2	4	6	4	–	1	1	12	4
										2	13	4	5	3	7	2	4	3	4		
11	29	52 32	03 52	15	4·96	35·19	4	4/5	2123	1	13	–	–	–	–	1	–	–	–	–	–
										2	13	–	–	–	–	1	–	–	–		
11	30	52 47	04 00	15	4·96	35·20	4	4	2320	1	13	–	–	5	1	–	–	–	1	–	–
										2	13	–	–	1	–	–	–	–	–		
12	31	52 54	03 42	14½	6·15	35·28	5	5	0143	1	12½	2	5	2	–	4	–	–	2	15	3
										2	12½	3	4	1	3	5	3	2	3		
12	32	53 02	03 24	13½	6·80	35·12	5/6	5/6	0357	1	11½	4	2	2	1	2	1	–	–	8	1
										2	11½	1	1	3	2	4	–	1	1		

'PLATESSA'. *Cruise* 3. 1947. 22–24 *January*

Day	Station	Position °N,	Position °E,	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
22	1	50 37	00 26	25	7·90	35·00	2	2	1526	1, 2	23	–	–	–	–	–	–	–	–	–	–
22	2	50 23	00 31	25	8·73	35·25	3	3	1712	1	23	–	–	–	1	–	–	–	–	2	–
										2	23	1	–	1	–	–	–	–	–		
22	3	50 12	00 35	20	8·22	35·23	3	3	1847	1	18	–	1	1	6	1	–	–	–	2	–
										2	18	–	–	–	2	–	–	–	–		
22	4	50 02	00 39	18	7·89	35·21	3	3	2008	1	16	–	–	–	–	1	–	–	–	–	–
										2	16	–	–	–	1	–	–	–	–		
22	5	50 15	01 01	18	6·92	35·24	4	4	2250	1	16	1	–	–	–	–	–	–	–	1	–
										2	16	–	–	–	–	–	–	–	–		
23	6	50 28	00 51	18	8·30	35·39	4	4	0100	1	16	8	6	3	2	1	–	–	–	25	–
										2	16	3	4	1	–	1	–	–	–		
23	7	50 37	00 44	24	8·61	35·31	5	4	0254	1	22	–	–	–	–	–	4	–	–	3	8
										2	22	2	1	3	1	5	3	–	1		
23	8	50 28	01 15	19	7·79	35·28	3	3	1040	1	17	2	2	–	6	1	5	–		12	10
										2	17	3	–	1	4	–	1	–	–		
23	9	50 42	01 21	9	8·39	35·07	5	5	1210	1	6	–	2	–	–	4	–	–	–	4	4
										2	6	1	–	–	1	–	3	–	–		
23	10	50 37	01 07	20	8·26	35·25	5	5	1315	1	18	1	–	1	2	–	3	–	–	1	7
										2	18	–	–	2	1	1	4	–	–		
23	11	50 46	01 00	20	7·65	35·16	5	5	1400	1	18	–	–	–	–	–	–	–	–	1	–
										2	18	–	1	–	–	–	–	–	–		
24	12	50 54	01 05	23	7·15	35·03	2	2	0955	1	21	–	–	–	–	–	1	–	–	–	3
										2	21	–	–	1	–	–	1	–	–		
24	13	50 53	01 16	17	7·89	35·23	3	3	1120	1	15	–	–	–	1	2	–	–	–	1	–
										2	15	1	–	–	–	1	–	–	–		
24	14	50 52	01 28	28	6·43	34·94	2	2	1325	1	26	–	–	–	1	–	1	–	–	3	2
										2	26	2	–	–	–	–	–	–	–		
24	15	51 02	01 32	28	7·62	35·39	3	3	1505	1	26	5	6	17	19	11	2	–	–	24	3
										2	26	3	1	3	4	7	–	–	–		
24	16	51 10	01 42	19	7·71	34·89	5	4	1630	1	17	3	3	4	–	–	1	–	–	12	2
										2	17	2	2	2	2	1	1	–	1		
24	17	51 19	01 52	20	7·76	35·30	4	4	1815	1	18	6	2	4	4	5	5	2	1	21	9
										2	18	6	3	3	3	7	2	1	–		

'SIR LANCELOT'. *Cruise* 3. 1947. 24–28 *January*

Day	Station	Position °N,	Position °E,	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
24	1	52 15	02 27	23	7·5	35·30	3	4	1355	1	21	6	3	–	–	–	–	–	2	25	–
										2	21	5	5	3	1	–	–	–	–		
24	2	52 08	02 13	32	7·4	35·25	3	3	1547	1	31	3	1	–	–	–	–	–	–	12	–
										2	31	1	3	–	–	–	–	–	–		
24	3	52 00	02 27	23	7·4	35·33	3	3	1741	1	21	4	2	4	3	1	3	–	1	20	15
										2	21	3	3	3	4	8	6	3	–		
24	4	51 51	02 14	24	7·9	35·34	3	3	2203	1	21	9	7	7	12	3	6	2	1	55	21
										2	21	12	4	11	7	6	6	–	2		
24	5	51 41	02 00	23	8·0	35·29	3	3	2315	1	22	4	1	–	1	4	2	1	1	16	3
										2	22	5	–	3	4	2	–	1	1		
24	6	51 32½	02 14	24½	7·6	35·31	3	2	0050	1	22	1	2	4	5	–	2	1	2	10	5
										2	22	1	2	3	6	4	1	–	–		
25	7	51 41	02 29	20	7·1	35·35	3	2	0222	1	18	3	1	1	3	2	–	–	–	15	2
										2	18	3	2	1	2	–	1	–	–		
25	8	51 36	02 43	22	6·6	35·24	2	2	0354	1	20½	1	2	5	6	–	–	–	–	7	–
										2	18	–	1	2	2	–	–	–	–		
25	9	51 43	03 00	14½	5·6	35·04	3	2	0548	1	10	3	2	2	6	–	2	–	–	24	9
										2	10	2	4	7	8	–	2	–	1		
25	10	51 51	02 45	20	6·6	35·31	2	2	0714	1	16	3	1	2	7	1	3	1	1	30	17
										2	16	7	5	12	9	6	6	–	1		
25	11	52 08	02 43	23	6·6	35·25	2	2	0925	1	21	4	2	7	8	6	2	–	1	44	12
										2	21	11	10	14	6	6	5	–	–		
25	12	52 00	03 00	18	5·7	35·03	2	2	1105	1	16	5	6	6	11	13	8	–	3	51	37
										2	16	14	5	11	4	12	14	–	4		
25	13	51 51	03 13	18	4·8	34·81	3	2	1230	1	14	18	8	5	4	5	5	–	–	89	15
										2	14	12	8	5	5	5	3	–	–		
25	14	52 02	03 25	17	4·9	35·07	2	2	1412	1	13	2	–	2	3	1	6	–	–	12	18
										2	13	4	–	–	1	7	3	–	–		
25	15	52 10	03 07	19	5·8	35·13	2	2	1552	1	17	–	1	1	1	1	31	2	4	8	74
										2	17	3	1	3	2	4	13	–	–		
25	16	52 17	02 51	23	6·4	35·13	3	2	1725	1	21	3	1	4	3	1	1	–	6	20	3
										2	21	5	3	2	2	–	1	–	3		
25	17	52 24	02 35	23	7·2	35·29	4/5	4/5	1905	1	22	16	13	9	4	–	–	1	4	66	–
										2	22	18	13	8	3	–	–	3	8		
26	19	52 20	03 48	15	4·4	35·16	5	5	0157	1	10	–	–	–	–	–	–	4	–	–	3
										2	10	–	–	–	–	–	2	1	4		
28	20	52 33	03 52	14½	3·9	35·30	5	5	0104	1	12	1	–	–	–	–	–	–	1	2	3
										2	12	–	1	1	2	–	3	1	2		
28	21	52 30	03 22	15	5·6	35·24	5	5	0335	1	14	3	2	1	1	1	2	3	6	8	2
										2	14	1	2	–	2	1	–	5	4		
28	22	52 46	02 40	24	5·6	35·07	5	5	1418	1	14	2	1	3	2	–	1	–	1	8	2
										2	14	1	1	2	1	–	–	–	–		

'SIR LANCELOT'. *Cruise* 6. 1947. 11–14 *March*

Day	Station	Position °N ′	Position °E ′	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
11	2	52 21	02 10	21	1·60	34·92	5	4/5	1445	1	18	–	–	–	–	1	2	–	–	–	2
										2	18	–	–	–	1	1	–	–	–		
11	3	52 16	02 27	23½	2·71	34·24	5	5	1705	1	20	5	1	4	–	9	3	–	–	18	4
										2	20	6	4	7	5	3	1	–	1		
11	4	52 08	02 43	24	3·36	35·28	4	5	1842	1	22	–	–	1	–	–	–	–	1	–	1
										2	22	–	–	–	–	–	1	–	1		
11	5	52 00	03 00	19	2·79	35·28	4	4/5	2035	1	16½	1	–	2	–	–	1	–	1	3	1
										2	16½	–	1	1	–	–	–	–	1		
11	6	51 51	03 13	16	1·60	34·81	4	4	2220	1	14	2	2	2	3	–	–	1	2	11	1
										2	14	1	1	3	3	–	–	–	3		
										3	14	3	4	7	–	–	1	–	3		
12	7	52 02	03 25	17½	1·90	35·27	3/4	3/4	0030	1	15	1	–	–	–	–	1	–	–	1	3
										2	15	–	–	2	–	–	1	–	2		
12	8	52 02	03 55	13½	0·47	33·92	3	3	0322	1	11	–	–	1	2	12	12	8	2	–	42
										2	11	–	–	–	–	6	11	10	1		
12	9	52 09	03 39	14	1·32	35·24	3	3	0516	1	12	–	1	3	4	6	6	1	2	7	19
										2	12	1	2	3	4	5	5	4	3		
12	10	52 16	03 23	17	2·12	35·38	3	3	0712	1	15	2	–	1	2	1	1	–	–	8	7
										2	15	2	1	3	4	–	3	1	1		
12	11	52 23	03 06	19½	2·95	35·38	3	3	0905	1	18	1	–	–	–	1	–	–	1	3	–
										2	18	1	–	–	–	1	–	1	–		
12	12	52 30	02 50	24½	3·00	35·16	3	3	1325	1	22½	3	2	7	17	10	13	3	3	18	36
										2	22½	4	2	9	13	10	9	1	1		
12	13	52 34	02 33	24½	2·01	34·54	4	3	1458	1	22½	–	–	–	1	2	3	1	–	–	12
										2	22½	–	–	–	–	1	6	1	1		
12	14	52 44	02 48	22	2·13	34·66	4	4	1632	1	21	2	–	3	3	3	10	–	1	5	15
										2	21	1	1	2	5	9	3	2	–		
12	15	52 40	03 08	17½	2·59	35·02	4	4	1808	1	15	2	2	5	7	5	8	1	–	8	14
										2	15	1	1	2	6	1	3	–	–		
12	16	52 37	03 30	16	2·37	35·43	4	3/4	1953	1	14	–	–	–	–	–	–	1	1	3	–
										2	14	2	–	–	1	1	–	1	1		
12	17	52 32	03 52	16	1·59	35·34	4/5	4	2134	1	14	1	–	5	5	3	9	2	10	4	26
										2	14	1	1	2	5	3	11	5	6		
12	18	52 47	04 00	16	1·55	35·37	5	5	2330	1	14	1	1	–	6	2	3	–	1	3	8
										2	14	–	1	1	1	1	4	–	1		
13	19	52 54	03 42	16	2·39	35·37	5	5	0108	1	15	1	1	4	8	5	6	9	6	10	11
										2	15	7	1	7	8	2	5	3	9		
13	20	53 02	03 23	15	1·43	34·59	5/6	5	0230	1	14	–	3	7	5	3	8	3	3	5	14
										2	14	1	1	6	4	2	6	–	–		
13	21	53 12	03 11	14	1·08	34·33	5/6	5	0350	1	11½	–	1	1	–	–	2	3	1	2	3
										2	11½	–	1	1	–	–	1	1	1		
13	22	53 25	02 58	16½	1·01	34·34	6	6	0537	1	14	2	2	–	–	–	–	2	1	5	–
										2	14	–	1	–	–	1	–	4	3		
13	23	53 39	02 38	19	0·53	34·93	6	6	0750	1	20	–	–	–	1	1	1	1	1	–	2
										2	20	–	–	2	–	1	1	2	3		
13	24	54 00	02 19	38	1·22	34·75	6	6	1017	1	38	–	–	–	–	–	3	4	2	–	7
										2	38	–	–	–	1	1	5	2	3		
13	25	54 18	02 01	22	1·50	34·70	6	6	1327	1	20	–	–	–	–	1	–	2	–	–	–
										2	20	–	–	–	–	1	–	1	–		
14	32	52 43	02 18	28½	0·51	34·32	5	5	1645	1	26½	–	–	–	–	–	1	–	–	–	1
										2	26½	–	–	–	–	–	–	–	3		
14	33	52 35	02 04	14	0·61	34·38	5	5	1840	1	12½	–	–	–	–	–	–	–	1	–	–
										2	12½	–	–	–	–	–	–	–	–		

'SIR LANCELOT'. *Cruise* 28. 1947. 17–21 *December*

Day	Station	Position N ° ′	Position E ° ′	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
17	1	52 05	02 11	26	10·0	34·91	4/5	4	1523	1–3	25	–	–	–	–	–	–	–	–	–	–
17	2	51 57	02 26	26	10·2	35·12	5	5	1718	1	24	–	2	–	2	–	–	–	–	7	–
										2	24	3	2	–	–	–	–	–	–		
										3	24	2	1	1	1	–	–	–	–		
17	3	51 48	02 13	24	10·1	35·13	6	5	1919	1–3	24	–	–	–	–	–	–	–	–	–	–
17	4	51 39	02 00	15	10·1	35·12	7	5/6	2122	1, 2	13	–	–	–	–	–	–	–	–	–	
										3	13	–	–	–	–	–	–	–	1		
17	5	51 30	01 45	18	8·9	34·95	7	5	2241	1–3	19	–	–	–	–	–	–	–	–	–	–
18	6	51 22	02 00	21	9·9	35·12	4	3	1456	1	19½	1	–	–	–	–	–	–	–	3	
										2	19½	1	1	–	1	–	–	–	–		
										3	19½	–	–	1	–	–	–	–	–		
18	7	51 12	01 46	22	10·0	35·11	3	2	1910	1	19½	–	1	2	–	–	–	–	–	5	–
										2	19½	–	1	2	–	–	–	–	–		
										3	19½	2	–	–	–	–	–	–	–		
18	8	51 03	01 33	27	10·1	35·11	3	3	2045	1	25	–	3	1	–	–	–	–	–	5	–
										2	25	–	2	–	–	–	–	–	–		
										3	25	–	–	1	1	–	–	–	–		
19	9	51 12	02 00	20	9·8	35·10	3	3	0001	1	18	1	1	–	2	1	–	–	–	7	–
										2	18	1	–	–	2	–	–	–	–		
										3	18	2	1	1	1	1	–	–	–		
19	10	51 21	02 28	18	7·2	33·58	2	2	0248	1–3	16½	–	–	–	–	–	–	–	–	–	–
19	11	51 32	02 15	24	9·6	35·15	3	2	0434	1	22	6	4	1	–	–	–	–	–	22	1
										2	22	3	1	3	–	–	–	–	–		
										3	22	6	–	2	3	1	1	–	–		
19	12	51 41	02 30	21	9·6	35·19	4	3	0617	1	19	2	3	1	1	–	–	–	–	11	–
										2	19	2	2	2	1	–	–	–	–		
										3	20	3	1	2	1	1	–	–	–		
19	13	51 49	02 43	21	9·5	35·02	4/5	4	0749	1	19	–	1	–	–	–	–	–	–	11	–
										2	19	4	–	–	1	–	–	–	–		
										3	19	7	1	1	–	–	–	–	–		
19	14	51 36	02 45	17	8·2	33·96	5/6	5	0925	1–3	15	–	–	–	–	–	–	–	–	–	–
19	15	51 43	02 58	18	9·1	34·56	7	6	1116	1–3	16	–	–	–	–	–	–	–	–	–	–
19	16	51 51	03 13	17	8·9	34·18	7	6	1322	1–3	15	–	–	–	–	–	–	–	–	–	–
19	17	51 58	02 56	22	10·0	34·95	6	5/6	2107	1	19½	5	1	–	–	–	–	–	–	6	–
										2	20	2	–	–	–	–	–	–	–		
										3	20	2	–	–	–	–	–	–	–		
20	18	52 05	02 40	26	10·2	34·66	4	4/5	0022	1–3	23	–	–	–	–	–	–	–	–	–	–
20	19	52 12	02 24	21	7·5	34·30	4	4	0231	1–3	19	–	–	–	–	–	–	–	–	–	–
20	20	52 21	02 37	25	7·9	34·43	4	4	0433	1–3	23	–	–	–	–	–	–	–	–	–	–
20	21	52 14	02 53	25	9·9	34·66	4/5	4	0611	1–3	23	–	–	–	–	–	–	–	–	–	–
20	22	52 07	03 09	21	9·9	34·97	5	4	0756	1, 2	19	–	–	–	–	–	–	–	–	1	–
										3	19	1	–	–	–	–	–	–	–		
20	23	52 00	03 26	18	9·3	34·87	5	4	0940	1–3	16½	–	–	–	–	–	–	–	–	–	–
20	24	52 09	03 39	14	9·0	34·87	5	4	1125	1–3	12	–	–	–	–	–	–	–	–	–	–
20	25	52 16	03 22	18	9·4	35·02	5	4	1317	1–3	18	–	–	–	–	–	–	–	–	–	–
20	26	52 26	03 36	17	9·1	35·15	5	4	1518	1, 3	15	–	–	–	–	–	–	–	–	1	–
										2	15	1	–	–	–	–	–	–	–		
20	27	52 32	03 20	22	9·5	35·06	5/6	5	1711	1–3	20	–	–	–	–	–	–	–	–	–	–
20	28	52 23	03 06	21	10·0	34·93	6	5	1900	1, 3	18½	–	–	–	–	–	–	–	–	1	–
										2	18	1	–	1	–	–	–	–	–		
20	29	52 30	02 50	26	9·8	34·52	6	5	2116	1–3	24	–	–	–	–	–	–	–	–	–	–
20	30	52 37	02 33	29	7·9	34·43	6/7	5	2330	1–3	27	–	–	–	–	–	–	–	–	–	–
21	31	52 43	02 18	27	7·9	34·64	6/7	5/6	0135	1–3	24	–	–	–	–	–	–	–	–	–	–
21	32	52 35	02 04	16	7·7	34·47	6	5	0337	1	14	–	–	–	–	–	–	–	–	–	–

'SIR LANCELOT'. *Cruise* 1. 1948. 7–11 *January*

Day	Station	Position N ° ′	Position E ° ′	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
7	1	52 21	02 37	24	9·10	35·00	4	4	1105	1	22		1	1	–	–	–	–	–		
										2	22		–	–	–	–	1	–	–	1	1
										3	22	–	–	2	–	–	–	–	–		
7	2	52 14	02 53	19	8·68	35·09	4	4/3	1258	1	18	2	–	3	3	–	–	1	–		
										2	18	3	1	4	2	5	1	2	1	8	3
										3	18	1	3	3	6	2	3	1			
7	3	52 07	03 09	19	8·36	34·83	3/4	3	1444	1	17	3	2	2	1	–	–	–	–		
										2	17	4	1		1	3	1			13	1
										3	17	2	–	–	1	1	–	–	–		
7	4	52 00	03 26	17	7·69	33·91	3	3	1623	1–3	15	–		–	–	–	–	–	–	–	–
7	5	51 51	03 13	14	7·34	33·89	3	3	1820	1–3	12	–	–	–	–		–		–	–	–
7	6	51 58	02 56	18	8·53	35·14	3/4	3/4	1957	1	16	5	2	9	8	2	–	–	–		
										2	16	10	5	5	9	2	–	–	–	28	1
										3	16	4	5	–	4	2	1	–			
7	7	52 05	02 40	22	9·06	35·18	5	4/5	2142	1	20	15	6	4	3	–	–	–	–		
										2	20	16	5	11	10	–	1	–		44	1
										3	20	14	8	6	5	2	–	–	–		
8	8	52 12	02 24	22	8·68	35·06	7	5/6	0001	1–3	20	–	–	–	–	–	–	–	–	–	–
9	9	52 03	02 11	20	8·30	35·05	4	3/4	1031	1–3	19	–	–	–	–	–	–		–	–	–
9	10	51 57	02 26	23	8·72	35·20	4	4	1213	1	21	1	–	6	1	–	–	–	–		
										2	21	3	1	3	–	–	–	–	–	10	1
										3	21	5	2	–	–	–	1	–	–		
9	11	51 49	02 43	18	8·12	34·99	4/5	4	1355	1	16	10	10	9	3	1	–	–	–		
										2	16	9	10	2	5	1	–	–	–	56	–
										3	16	11	16	8	4	–	–	–	–		
9	12	51 43	02 58	18	7·36	34·32	5	4	1553	1–3	16	–	–	–	–	–	–	–	–	–	–
9	13	51 36	02 45	17	8·05	34·88	5/6	4/5	1743	1	15	–	–	–	–	–		–	–		
										2	15	–	1	–	–	–	–	–	–	2	–
										3	15	1	1	–	–	–	–	–			
9	14	51 41	02 30	16	8·58	35·07	6	5	1911	1	14	13	8	9	3	1	–	–	–		
										2	14	12	9	7	5	1	–	–	–	42	–
										3	14	11	10	4	2	2	–	1	–		
9	15	51 32	02 15	11	8·78	35·07	6/7	5	2115	1	9	4	–	1	2	–	–	–	2		
										3	9	9	1	2	2	–	–	2	2	14	–
9	16	51 21	02 28	18	8·38	34·94	7	5/6	2310	1	16	2	–	–	–	–	–	1	–		
										2	16	–	–	1	–	–	–	1	–	2	–
										3	16	–	1	–	–	–	–	1	–		
10	17	51 19	01 53	19	9·43	35·07	6	5	0802	1	17	20	4	1	–	1	–	–	–		
										2	17	15	3		–	–	–	–	–	37	1
										3	17	14	1		–	–	2		–		
10	18	51 12	01 46	23	9·54	35·07	5	5	0937	1	21	5	–	2	2	3	–	–	–		
										2	21	9	–	–	–	2	1	–	1	16	3
										3	21	9	–	–	2	–	3		1		
10	19	51 12	02 00	20	9·10	34·92	4	5/4	1051	1	18	–	–	–	–	–	–	1	1		
										2	18	–	–	–	–	–		–	1	–	1
										3	18	–	–	–	–	–	1	–	1		
10	20	51 03	01 31	19	9·08	35·07	2	3	1348	1	17	–	–	–	4	5		–	–		
										2	17	–	–	2	2	1	–	–		–	–
										3	17	–	–	1	2	3	–	–	–		
10	21	51 18	01 37	14	8·50	35·05	3	2	1521	1	13	–	–	1	1		–	–			
										2	13	–	–	–	–	–	–	–	–	1	–
										3	13	1	–	–	–	–	–	–	–		
10	22	51 30	01 45	20	8·64	35·05	3	2	1702	1	18	–	–	–	–	–	–	–	–		
										2	18	–	–	–		–	–	1	–	1	–
										3	18	–	1	–	–	1		–	–		
10	23	51 39	02 00	25	8·56	35·07	3	2	1849	1	23	–	2	2	1		2	–	–		
										2	23	4	1	–	3		3	1	–	14	7
										3	23	–	6	1	–		1	1			
10	24	51 48	02 13	25	8·74	35·10	3	2	2036	1	23	1	2	–	3	–	–				
										2	23	–	2	–	1	1	1	6	–	7	2
										3	23	–	1	–	4	1	1	1	1		
11	25	52 16	03 22	12	7·95	34·87	4	4	0208	1	10	1	–	1	–	–	–		–		
										2	10	2	–	–	1	1	–	–	–	3	–
										3	10	–	–	1	–	1	–	–	–		
11	26	52 23	03 06	16	8·21	35·11	4/5	4	0340	1	14	3	2	3	1	4	–	–	–		5
										2	14	2	–	2	2	4	4	–	1	11	
										3	14	5	1	2	3	2	2	1	–		
11	27	52 30	02 50	22	8·60	35·08	5	4/5	0512	1	20	1	–	1	1	1	1	–	–		
										2	20	3	3	–	2	2	3	–	–	6	3
										3	20	–	1	–	1	1	–	1	–		

'SIR LANCELOT'. *Cruise* 2. 1948. 15–17 *January*

Day	Station	Position °N,	Position °E,	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
15	8	54 22	02 27	16	6·1	34·54	7	6/7	2351	1–3	14	–	–	–	–	–	–	–	–	–	–
16	9	54 21	03 03	22	6·3	34·54	6	6	0514	1	20	–	–	–	–	–	–	–	–		
										2	20	–	–	3	–	–	–	–	–	–	–
										3	20	–	–	–	1	–	–	–	–		
16	10	54 20	03 33	22	6·3	34·59	5	5	0933	1	20½	–	–	1	–	–	–	–	–		
										2	20½	–	1	–	–	–	–	–	–	1	–
										3	20½	–	–	–	–	–	–	–	–		
16	11	54 19	04 10	25	6·7	34·59	4/5	5	1218	1	23	1	1	–	–	–	–	–	–		
										2, 3	23	–	–	–	–	–	–	–	–	1	–
16	12	54 18	04 43	23	6·9	34·50	4	4	1533	1	22	–	1	–	–	–	–	–	–		
										2	22	1	–	–	–	–	–	–	–	2	–
										3	22	–	–	2	–	–	–	–	–		
16	13	54 18	05 01	22	6·6	34·58	4	3	1741	1, 2	20	–	–	–	–	–	–	–	–		
										3	20½	–	–	–	–	–	1	–	–	–	1
16	14	54 18	05 18	22	6·6	34·61	3/4	3	1911	1	20½	–	–	–	1	1	–	1	–		
										2	20½	–	–	1	–	–	1	–	–	1	1
										3	20½	–	–	–	–	–	–	–	–		
16	15	54 18	05 34	20	6·6	34·56	2/3	2	2051	1	18	–	–	–	–	–	–	–	–		
										2	18	–	–	1	1	–	1	–	–	1	2
										3	18	–	1	–	1	–	1	–	–		
16	16	54 17	05 49	20	6·8	34·53	2/3	2	2209	1	18	–	–	–	–	–	–	–	–		
										2	18	1	–	–	–	–	–	–	–	1	–
										3	18	–	–	–	–	1	–	–	–		
16	17	54 17	06 06	20	6·8	34·56	3	2	2331	1–3	18	–	–	–	–	–	–	–	–	–	–
17	18	54 17	06 23	18	6·5	34·38	3	2	0039	1	15	–	–	1	–	–	–	–	–		
										2	15	1	–	–	–	–	–	–	–	1	–
										3	15	–	–	–	–	–	–	–	–		
17	19	54 17	06 40	18	6·4	34·38	3	2	0202	1–3	15	–	–	–	–	–	–	–	–	–	–
17	20	54 17	06 57	17	6·1	34·20	3/4	3	0320	1–3	14	–	–	–	–	–	–	–	–	–	–
17	21	54 32	06 57	19	6·3	34·45	4	3	0525	1–3	18	–	–	–	–	–	–	–	–	–	–
17	22	54 32	06 38	19	6·4	34·49	4	3	0656	1	18	–	–	–	–	–	–	–	–		
										2	18	–	1	–	–	–	–	–	–	1	–
										3	18	–	–	–	–	–	–	–	–		
17	23	54 32	06 18	19	6·5	34·50	4/5	4	0831	1	17½	–	–	1	–	–	–	–	–		
										2, 3	17½	–	–	–	–	–	–	–	–	–	–
17	24	54 32	05 57	21	6·4	34·56	5/6	4/5	1008	1	20	–	–	–	–	–	–	–	–		
										2	20	–	1	1	–	–	1	–	–	1	1
										3	20	–	1	–	–	–	–	–	–		
17	25	54 32	05 33	21	6·6	34·61	6	5	1219	1, 2	20	–	–	–	–	–	–	–	–		
										3	20	1	–	–	–	–	–	–	–	1	–
17	26	54 32	05 15	21	6·6	34·61	6/7	6	1442	1	20	–	1	–	–	–	–	–	–		
										2	20	–	–	1	–	–	–	–	–		
										3	20	–	–	–	–	–	1	–	–	1	1

'SIR LANCELOT'. *Cruise* 3. 1948. 27 *January* – 1 *February*

Day	Station	Position °N	Position °E	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Egg Stages IA	Egg Stages IB	Egg Stages II	Egg Stages III	Egg Stages IV	Egg Stages V	Larvae	Post Larvae	Mean per Station I per m²	Mean per Station V per m²
27	1	52 03	02 11	24	8·6	35·05	4	2	1418	1	23	1	1	1	3	3	1	3	–	5	10
										2	23	2	–	2	4	3	2	–	7		
										3	23	–	1	2	2	6	7	3	4		
27	2	51 57	02 26	24	8·9	35·05	4	3	1608	1	23	16	5	11	18	23	5	–	–	45	15
										2	23	7	6	10	9	11	6	–	2		
										3	23	11	8	14	16	8	7	–	–		
27	3	51 49	02 29	21	8·8	35·03	4	3	1725	1	19	8	3	6	9	6	7	2	–	33	22
										2	19	7	1	5	6	9	9	1	1		
										3	19	14	4	4	11	18	9	–	1		
27	4	51 43	02 17	18	–	–	3,4	3	2233	1	17	2	7	5	12	5	2	1	2	46	5
										2	17	11	6	9	8	1	–	2	1		
										3	17	12	5	7	8	10	3	1	1		
28	5	51 48	02 13	22	9·0	34·96	3	3	0000	1	20	3	–	9	12	3	3	5	–	14	6
										2	20	1	3	2	5	2	2	8	1		
										3	20	4	2	7	6	6	–	4	3		
28	6	51 39	02 00	24	8·9	35·02	3	3	0143	1	22	2	7	9	7	1	4	5	3	46	19
										2	22	8	7	7	5	2	5	4	4		
										3	22	6	12	5	9	3	8	2	5		
28	7	51 31	01 45	20	8·5	35·01	3	2	0400	1	19	–	–	–	1	–	–	1	–	1	1
										2	19	–	1	–	–	3	–	2	2		
										3	19	–	–	1	–	3	1	4	1		
28	8	51 22	02 00	18	9·0	34·95	3	2	0603	1	17	6	2	–	–	4	–	–	1	40	3
										2	17	11	2	–	2	–	1	1	2		
										3	17	16	1	–	1	–	2	–	–		
28	9	51 12	01 46	20	9·1	35·02	4	2/3	0752	1	18½	9	–	1	3	4	–	–	1	29	3
										2	18½	7	–	–	1	–	2	1	–		
										3	18½	11	–	–	1	7	1	–	1		
28	10	51 02	01 32	26	9·2	35·11	5	4/5	0932	1	24	2	–	4	2	–	1	–	–	8	1
										2	24	5	–	5	5	2	–	–	–		
										3	24	4	–	1	10	–	–	2	–		
28	11	51 12	02 00	18	8·5	34·67	5	4/5	1215	1	16	1	–	–	1	–	–	–	–	2	–
										2	16	1	–	2	–	–	–	–	–		
										3	16	1	–	2	–	–	–	–	–		
28	12	51 22	02 28	17	8·1	34·85	4	4	1416	1	15	3	1	–	–	–	–	–	–	11	
										2	15	3	2	1	–	–	–	1	–		
										3	15	4	–	1	–	–	–	1	–		
28	13	51 32	02 15	20	8·9	35·02	4	4	1608	1	18	–	7	10	10	1	–	–	3	16	–
										2	18	3	5	6	13	–	–	4	–		
										3	18	1	3	8	9	2	–	2	–		
28	14	51 41	02 31	19	8·8	35·02	4	4	1724	1	17	1	2	5	14	7	4	–	–	14	5
										2	17	6	1	6	15	6	–	2	1		
										3	17	5	2	2	21	9	2	1	–		
28	15	51 50	02 43	19	8·6	35·01	4	4	1838	1	17	5	3	13	18	8	2	3	–	23	7
										2	17	5	4	5	12	6	1	1	2		
										3	17	9	1	11	10	4	5	1	3		
28	16	51 36	02 45	15	8·4	35·03	5	4/5	2043	1	12	2	–	–	–	–	–	–	1	8	–
										2	12	5	–	1	–	–	–	–	1		
										3	12	2	1	1	–	–	–	1	3		
28	17	51 43	02 58	14	8·2	34·93	5	4/5	2223	1	13	9	5	1	2	–	–	–	–	28	–
										2	13	10	4	1	2	–	–	–	–		
										3	13	9	5	–	4	–	–	–	1		
29	18	51 52	03 12	14	7·9	34·96	5	4/5	0006	1	12	4	2	1	6	3	–	1	1	20	1
										2	12	6	2	8	6	2	2	1	2		
										3	12	7	6	7	5	2	–	1	1		
29	19	51 58	02 57	18	8·3	35·01	4/5	4	0150	1	17½	2	4	8	12	7	13	8	3	15	23
										2	17½	5	2	2	9	7	6	6	6		
										3	17½	–	6	7	12	5	11	1	8		
29	20	52 05	02 40	22	8·7	35·02	4	4	0337	1	20	9	4	15	17	16	9	8	10	32	20
										2	20	8	4	6	22	8	8	3	6		
										3	20	7	7	9	13	11	7	2	13		
29	21	52 12	02 24	22	8·6	35·05	4	4	0525	1	20	3	3	2	3	4	5	2	3	16	12
										2	20	5	4	2	8	8	4	4	7		
										3	20	3	1	4	3	5	6	5	5		
29	22	52 19	02 08	22	7·6	35·06	4	4	0703	1	20	–	–	–	–	–	–	1	2	–	–
										2	20	–	–	–	–	–	–	–	–		
										3	20	–	–	–	–	–	–	1	1		
29	23	52 21	02 37	22	8·3	35·07	3	3	0908	1	20	7	2	5	3	3	–	1	–	18	3
										2	20	3	2	5	3	2	2	2	4		
										3	20	2	–	2	3	1	1	1	–		
29	24	52 19	02 41	22	–	–	4	3/4	0945	1	20	4	3	4	4	5	1	1	1	24	2
										2	20	4	3	8	5	1	1	1	–		
										3	20	10	5	5	7	3	1	1	1		
29	25	52 17½	02 45	23	–	–	5	4/5	1025	1	21	4	3	3	10	2	1	–	3	18	2
										2	21	8	2	8	4	–	–	3	–		
										3	21	5	4	8	6	2	2	1	1		
29	26	52 16	02 49	19	–		5	4/5	1107	1	18	3	–	2	1	–	–	–	1	13	1
										2	18	6	4	4	2	2	–	–	2		
										3	18	5	2	6	1	2	2	–	3		
29	27	52 14	02 54	20	8·3	35·06	5	5	1145	1	18	3	–	3	–	–	1	–	2	14	1
										2	18	6	2	–	–	1	1	–	1		
										3	18	8	1	1	1	1	–	–	2		
29	28	52 07	03 10	17	7·8	35·03	5	5	1340	1	15½	9	2	5	10	13	15	1	8	21	26
										2	15½	13	3	6	12	9	8	2	5		
										3	15½	4	–	6	18	12	14	4	7		
29	29	52 00	03 26	15	7·6	34·90	4	4	1527	1	13	–	–	1	3	1	–	–	–	1	–
										2	13	–	1	1	1	2	–	–	–		
										3	13	–	–	2	7	–	–	–	1		

'SIR LANCELOT'. *Cruise* 3. 1948. 27 *January* – 1 *February* (*cont'd.*)

Day	Station	Position °N ′	Position °E ′	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Hau: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
29	30	52 09	03 39	12	6·8	34·50	2	3	1646	1	10	–	–	–	2	3	–	–	–	–	2
										2	10	–	–	2	–	–	2	–	–		
										3	10	–	–	–	2	2	–	–	–		
29	31	52 16	03 23	16	7·5	34·93	3	3	1618	1	13	9	9	4	12	7	4	1	2	44	14
										2	13	2	4	3	7	6	3	2	1		
										3	13	5	7	9	16	4	4	–	1		
29	32	52 23	03 07	20	8·0	35·03	5	4/5	2000	1	18	10	8	4	7	2	–	–	2	28	2
										2	18	7	3	10	5	1	1	–	3		
										3	18	7	5	8	9	1	2	2	1		
29	33	52 30	02 50	20	8·2	35·06	4/5	4/5	2131	1	18	4	3	5	6	1	2	2	1	16	3
										2	18	7	3	5	4	2	2	–	1		
										3	18	1	2	6	3	1	-	2	1		
29	34	52 37	02 33	22	7·8	34·50	5	5	2313	1	20	–	1	–	–	–	–	–	–	2	–
										2	20	–	–	–	–	–	–	–	–		
										3	20	2	–	–	–	–	–	–	–		
30	35	52 46	02 46	20	7·6	35·01	5	5	0055	1	18	3	–	2	–	–	–	–	–	4	–
										2	18	2	–	–	–	–	–	–	–		
										3	18	1	–	1	–	–	–	–	–		
30	36	52 39	03 04	18	8·0	35·04	4	4/5	0240	1	17	3	3	1	4	–	–	1	–	20	1
										2	17	8	2	6	1	1	–	–	1		
										3	17	6	3	–	1	1	1	–	–		
30	37	52 32	03 20	17	7·5	34·99	5	5	0415	1	14	11	4	11	17	13	8	1	1	24	10
										2	14	7	3	8	14	6	3	1	3		
										3	14	4	3	12	12	7	2	3	2		
30	38	52 26	03 35	14	7·0	35·03	7	5/6	0558	1	12½	4	2	3	9	2	4	–	1	10	6
										2	12½	6	2	8	11	4	2	–	–		
										3	12½	2	–	5	15	2	3	–	–		
30	39	52 25	03 54	13	6·2	33·20	6/7	6/7	0739	1	11	–	–	–	–	1	–	–	–	–	–
										2, 3	11	–	–	–	–	–	–	–	–		
30	40	52 35	03 48	13	6·7	34·56	5/6	5	0908	1–3	11	–	–	–	–	–	–	–	–	–	–
30	41	52 41	03 33	15	7·3	35·00	6	6	1100	1	13	3	2	1	1	2	–	–	2	5	6
										2	13	–	1	–	3	3	4	–	–		
										3	13	2	–	3	4	3	5	1	–		
30	42	52 48	03 17	16	7·8	35·05	6/7	6	1259	1	14	3	7	3	3	–	1	2	–	13	1
										2	14	5	3	2	4	3	–	2	–		
										3	14	2	1	3	–	–	1	–	–		
30	43	52 56	03 00	14	7·6	35·04	7	6/7	1446	1	12	–	2	2	–	–	–	–	–	4	–
										2	12	3	1	1	–	–	–	–	–		
										3	12	2	–	2	1	–	–	–	–		
1	47	53 05	03 13	14	7·5	35·01	5	5	1450	1	12	3	–	1	–	1	–	–	–	4	–
										2	12	1	1	1	–	1	–	–	–		
										3	12	1	–	2	–	–	–	–	–		
1	48	52 58	03 29	13	7·8	35·02	5/6	5	1623	1	9	7	1	1	1	2	1	–	–	16	2
										2	9	2	2	1	2	1	–	–	1		
										3	9	2	4	–	2	–	1	–	–		
1	49	52 50	03 46	14	7·3	34·99	5	4/5	1758	1	12	1	1	–	–	–	1	–	–	4	1
										2	12	–	–	2	4	–	–	–	–		
										3	12	2	1	1	2	–	–	–	–		
1	50	53 00	03 58	14	7·3	35·01	5/6	5	1925	1	12	1	2	1	2	2	3	1	1	7	4
										2	12	4	1	4	1	2	1	1	–		
										3	12	1	–	3	1	1	1	–	1		
1	51	53 06	03 43	14	7·6	35·03	6	5/6	2114	1	12	2	1	5	3	2	–	3	1	7	1
										2	12	3	1	6	5	1	–	3	–		
										3	12	1	3	6	2	2	2	1	–		
1	52	53 13	03 25	15	7·7	35·07	6	5/6	2257	1	13	3	4	3	3	1	1	–	–	8	1
										2	13	1	1	3	5	3	–	1	–		
										3	13	2	1	4	3	2	1	1	–		

'SIR LANCELOT'. *Cruise* 4. 1948. 24–29 *February*

Day	Station	Position °N,	Position °E,	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
24	3	52 47	02 47	18	6·4	35·10	3	3	1432	1	16	3	2	2	–	–	–	2	–	10	1
										2	16	1	–	–	–	–	–	–	2		
										3	16	2	1	–	–	2	1	2	1		
24	4	52 55	02 59	17	5·6	35·04	3	3	1912	1	15	2	1	1	6	2	3	2	2	10	6
										2	15	1	1	2	–	2	–	5	1		
										3	15	3	1	2	5	–	2	4	3		
24	5	53 04	03 12	17	4·7	33·64	3	3	2118	1	15	1	1	–	–	–	–	2	1	3	6
										2	15	–	–	2	–	–	1	–	1		
										3	15	1	–	–	–	–	4	–	1		
24	6	53 13	03 26	14	4·8	34·35	3	3	2305	1	12	1	–	–	–	–	1	2	2	1	2
										2	12	–	–	2	–	–	–	2	–		
										3	12	–	–	–	–	–	1	7	–		
25	7	53 06	03 43	12	4·9	34·35	3	3	0048	1	10	–	–	1	–	–	–	–	–	4	2
										2	10	2	–	–	–	–	1	1	1		
										3	10	1	–	–	–	–	1	1	–		
25	8	53 00	03 59	12	5·0	34·38	3	3	0227	1	10	–	1	–	1	–	1	2	1	1	2
										2	10	–	–	–	1	–	1	2	1		
										3	10	–	–	1	1		–	1	2		
25	9	52 44	04 01	12	5·0	33·67	4	3	0434	1	10	–	–	–	–	–	–	1	–	–	–
										2	10	–	–	–	–	–	–	–	–		
										3	10	–	–	–	–	–	–	2	–		
25	10	52 50	03 46	14	5·0	34·13	4	4	0608	1	12	3	–	1	–	–	2	1	–	4	10
										2	12	2	–	–	–	–	5	2	2		
										3	12	–	–	–	–	–	4	3	3		
25	11	52 57	03 30	13	4·6	33·91	4/5	4	0754	1	11	–	1	–	–	–	4	–	–	9	5
										2	11	2	–	1	–	–	–	–	1		
										3	11	4	3	1	–	–	2	2	–		
25	12	52 48	03 17	16	4·9	34·38	5	4/5	0943	1	14	1	–	1	–	1	1	4	–	2	2
										2	14	2	–	–	1	1	1	1	–		
										3	14	–	–	–	–	1	1	–	1		
25	13	52 41	03 33	15	5·3	34·33	5	4	1146	1	13	–	–	–	–	–	–	–	2	2	1
										2	13	1	–	–	–	–	1	–	–		
										3	13	1	–	–	–	–	–	1	–		
25	14	52 35	03 48	14	5·1	34·33	5	4/5	1338	1, 2	11	–	–	–	–	–	–	–	–	–	–
										3	11	–	–	–	1	–	–	–	1		
25	15	52 26	03 35	15	5·1	34·73	5	5	1526	1	13	–	–	1	–	1	1	1	5	1	3
										2	13	–	–	2	1	1	1	3	1		
										3	13	–	1	2	–	–	2	5	–		
25	16	52 32	03 21	19	5·8	35·14	5	5	1655	1	17	1	1	–	2	1	–	–	–	3	–
										2	17	1	–	1	–	1	–	–	–		
										3	17	1	–	–	–	2	–	1	–		
25	17	52 39	03 04	14	6·0	35·13	5	5	1839	1	12	–	–	–	–	–	–	–	1	–	–
										2	12	–	–	–	–	–	–	1	–		
										3	12	–	–	–	–	–	–	1	–		
25	18	52 30	02 50	18	6·6	35·08	5/6	5	2014	1	16	2	2	1	3	1	2	1	–	9	3
										2	16	4	1	1	3	1	2	–	–		
										3	16	1	2	1	–	1	–	1	–		
25	19	52 23	03 06	15	6·1	35·09	6	5/6	2311	1	13	–	2	–	2	–	1	–	–	5	1
										2	13	2	2	1	1	–	–	–	–		
										3	13	1	–	–	1	–	–	–	–		
26	20	52 16	03 22	16	5·3	35·01	5/6	5	0157	1	13½	2	–	1	1	2	3	3	10	7	4
										2	13½	3	–	2	–	2	2	1	–		
										3	13½	1	3	–	1	2	1	1	8		
26	21	52 09	03 39	12	4·7	34·30	5	5	0400	1	10	–	–	–	–	–	–	3	4	1	–
										2	10	–	1	–	–	1	–	3	3		
										3	10	–	–	–	–	–	–	1	4		
26	22	52 00	03 26	15	5·0	33·81	5	5	0547	1	14	1	–	–	–	–	1	5	1	2	1
										2	14	–	–	2	–	–	1	2	3		
										3	14	2	–	–	–	–	–	4	3		
26	23	52 07	03 09	14	5·5	34·86	5	5	0725	1	12	–	1	4	1	1	2	3	4	3	5
										2	12	1	–	1	1	2	3	2	3		
										3	12	1	1	–	1	–	2	2	3		
26	24	52 14	02 54	17	6·3	35·05	5	5	0900	1	15	–	–	–	–	3	–	3	2	–	1
										2	15	–	–	–	–	1	1	1	–		
										3	15	–	–	–	–	2	–	2	–		
26	25	52 21	02 37	20	6·7	35·07	5	5	1034	1	18	3	3	3	6	–	2	1	–	12	4
										2	18	4	1	2	–	1	2	–	–		
										3	18	3	3	3	2	2	2	–	–		
26	26	52 28	02 21	21	5·8	34·87	6	5/6	1204	1	21	–	–	–	1	1	–	–	–	1	1
										2	21	2	–	–	2	–	–	–	–		
										3	21	–	–	2	2	2	1	–	–		
26	27	52 19	02 07	20	5·4	34·67	6/7	6/7	1350	1	18	–	–	4	–	–	–	–	–	–	–
										2	18	–	–	5	1	–	–	–	–		
										3	18	–	–	4	–	–	–	–	–		
27	28	51 51	03 12	14	5·0	33·82	4/5	4	0803	1	12½	–	1	2	1	1	1	8	–	3	4
										2	12½	–	1	–	–	2	–	2	1		
										3	12½	1	1	1	1	–	4	2	–		
27	29	51 44	02 58	12	4·8	33·78	4	4	1052	1	10	–	1	1	–	–	–	1	–	1	2
										2	10	–	–	–	–	1	2	3	–		
										3	10	–	–	–	–	–	–	–	–		
27	30	51 36	02 44	14	4·9	34·05	3	3	1125	1	12½	–	–	–	–	–	1	–	–	–	2
										2	12½	–	–	–	–	–	–	–	–		
										3	12½	–	–	–	–	–	1	–	–		
27	31	51 41	02 30	17	6·1	34·93	3	3	1249	1–3	14½	–	–	–	–	–	–	–	–	–	–
27	32	51 32	02 15	20	6·4	35·01	3	2	1443	1–3	18	–	–	–	–	–	–	–	–	–	–
27	33	51 21	02 03	16	6·4	35·02	2	2	1645	1–3	15	–	–	–	–	–	–	–	–	–	–
27	34	51 12	02 00	17	5·3	34·03	2	2	1808	1–3	15	–	–	–	–	–	–	–	–	–	–

'SIR LANCELOT'. *Cruise* 4. 1948. 24–29 *February* (*cont'd.*)

Day	Station	Position N ° ′	Position E ° ′	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
27	35	51 12	01 46	22	6·6	34·94	1	1	1929	1	20	–	–	–		–		1	–	–	1
										2	20	–	–		–	1	–	–	1		
										3	20	–			–		1	–	1		
27	36	51 30	01 45	16	4·6	34·81	2	1	2144	1, 2	17	–			–	–	–	–	–	–	
										3	17		–	–		–		–	1		
27	37	51 39	02 00	22	7·0	35·17	2	1	2334	1	20					–		–	1	–	
										2	20		–	–		–	–	1	–		
										3	20	–	–	–	–		–	–	3		
27	38	51 48	02 14	24	7·1	35·17	0	0	0149	1	22	–		–	–	1	–	–	–	–	3
										2	22	–		–	–		2		–		
										3	22	–	–	–	1		1		–		
28	42	52 03	02 11	21	5·2	34·67	0	0	1647	1–3	19½	–	–	–	–	–		–	–	–	–
28	43	51 57	02 26	22	7·0	35·17	0	0	1826	1	20	–	–	1	–	1	–	–	2		
										2	20	–	1	1	1	1	–	3	1	1	–
										3	20		–		1	2	–	–	2		
28	44	51 50	02 43	23	6·4	34·99	0	0	2003	1	21½	1	–	–	–	–	–	–	1	2	
										3	21½	–	–	–	–		–	–	–		
28	45	51 58	02 56	17	6·1	35·01	0	0	2151	1	15	–		–	–	–	–	–	1		
										2	15	–	–	–	–	–			–	–	–
										3	15	–	–	1	–	–		–	–		
28	46	52 05	02 40	22	6·8	35·08	Airs	0	2334	1	20	–		–	–	–	–		1		
										2	20	–		–	–	–	–		1	–	–
										3	20	–				1	–	–	–		
29	47	52 11	02 23	23	5·7	34·85	Airs	0	0452	1	21	–		–		1	–	–	–		
										2	21	–				1	–	–	–	–	–
										3	21	–			–	–	–	–	–		
29	48	52 19	02 08	17	4·2	34·22	Airs	0	0623	1–3	15	–	–		–	–		–	–	–	

'SIR LANCELOT'. *Cruise* 5. 1948. 3–8 *March*

Day	Station	Position N ° ′	Position E ° ′	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
3	1	52 53	02 30	20	4·80	34·51	1	1	1900	1	18	–	–	–	–	–	1	–	–		
										2	18	–	–	–	–	2	2	–	–	–	4
										3	18	–	–	–	–	–	1	–	–		
3	2	53 02	02 43	17	5·94	35·03	1	1	2037	1	15	1	1	2	–	6	3	3	1		
										2	15	3	2	–	–	5	5	2	–	12	14
										3	15	4	–	–	–	3	4	1			
3	3	53 09	02 26	16	5·32	34·96	0/1	0/1	2203	1	14	–		–	4	7	12	6	3		
										2	14	1	1	1	4	8	15	4	2	6	42
										3	14	1	2	1	6	10	10	3	2		
3	4	53 16	02 10	18	4·39	34·54	1	1	2337	1	16	–		–	2	3	1	1	1		
										2	16			–	5	–	4	1	1	1	6
										3	16	–	1	–	3	2	–	2	1		
4	5	53 25	02 23	18	4·34	34·49	1	1	0112	1	16	–		1	4	2	3	4	1		
										2	16	–	–	1	2	3	–	2	–	–	7
										3	16	–		2	5	–	3	2	–		
4	6	53 13	02 18	18	4·62	34·67	1	1	0253	1	16		–		1	1	–	2			
										2	16	–	–	–	2	–	4	1	2	–	4
										3	16	–	–	2	5	2	–	–	1		
4	7	53 01	02 13	18	4·90	34·76	1	1	0420	1	16	–	–	–	6	11	5	7	–		
										2	16	–	–	1	3	5	4	6	–	–	21
										3	16	–	–	1	3	4	10	7	–		
4	8	53 20	02 33	15	4·68	34·49	2	2	0841	1	13	–	–	–	3	2	3	3	–		
										2	13	–	1	1	–	1	–	3	–	1	6
										3	13	–	–	2	3	1	2	7			
4	9	53 14	02 49	15	5·61	35·12	2	2	1046	1	13	–	3	3	5	4	1	3	1		
										2	13	1	6	6	9	1	1	2	2	23	5
										3	13	7	3	2	3	4	2	2	1		
4	10	53 23	03 02	15	4·80	34·18	2	2	1225	1	13	–	–	–	2	–	–	6	1		
										2	13	1	–	–	–	2	–	9	1	1	–
										3	13	–	–	–		–	–	15			
4	11	53 30	02 44	15	4·38	34·36	2	2	1425	1	13	–	–	1	2	1	4	2	–		
										2	13	1	–	2	4	1	1	2	–	5	6
										3	13	1	2	1	2	4	–	3	1		
4	12	53 38	02 23	15	4·68	34·55	2	2	1629	1	13	–	–	–	3	1	–	–	–		
										2	13	–	–	–	1	–	–	2	–	–	2
										3	13	–	–	–	–	2	2	1	–		
4	13	53 50	02 38	18	4·61	34·46	2	2	1813	1	16	–	1	3	3	1	3	5	3		
										2	16	–	–	2	1	–	3	1	2	1	7
										3	16	–	–	–	3	–	–	1	–		
4	14	53 44	02 52	22	4·50	34·14	2	2	1937	1	20	–	–	–	2	2	1	3	–		
										2	20	–	–	1	1	–	1	1	1	2	2
										3	20	1	1	2	1	1	–	2	1		
4	15	53 36	03 07	20	4·51	34·22	1	1	2125	1	18	–	–	1	3	1	–	3	–		
										2	18	–	–	–	1	–	1	–	2	1	4
										3	18	–	1	2	3	–	3	1	3		

'SIR LANCELOT'. *Cruise* 5. 1948. 3–8 *March* (*cont'd.*)

Day	Station	Position		Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul								Mean per Station	
												Egg Stages						Larvae	Post Larvae		
		°N ′	°E ′									IA	IB	II	III	IV	V			I per m²	V per m²
4	16	53 30	03 24	18	4·46	34·33	Airs	1	2319	1	16	–	–	1	1	1	–	3	–	–	1
										2	16	–	–	2	–	–	–	3	–		
										3	16	–	–	1	–	–	1	–	–		
5	17	53 22	03 41	14	4·58	34·36	2	2	0904	1	12	–	1	–	1	–	1	2	1	2	2
										2	12	–	1	–	–	–	–	2	–		
										3	12	–	–	–	–	–	1	–	–		
5	18	53 15	04 00	13	4·60	34·34	2	2	1118	1	11	1	1	1	1	–	–	–	–	2	–
										2	11	–	–	2	1	–	–	–	–		
										3	11	–	–	–	1	1	–	1	–		
7	19	53 25	04 11	14	4·62	34·18	2	1	0904	1	12	–	1	–	–	1	–	1	–	1	–
										2	12	–	–	–	3	–	–	–	–		
										3	12	–	–	1	–	–	–	1	1		
7	20	53 33	04 22	14	4·37	33·60	2	2	1031	1	12	–	–	–	–	–	–	–	–	1	1
										2	12	1	–	–	–	–	1	–	–		
										3	12	–	–	–	–	–	–	–	1		
7	21	53 40	04 06	19	4·60	34·16	2	2	1157	1	17	1	–	–	–	–	–	1	1	1	4
										2	17	–	–	–	–	–	2	1	–		
										3	17	–	–	–	–	1	2	–	1		
7	22	53 30	03 54	16	4·76	34·19	3	2	1342	1	14	–	–	1	–	–	–	1	1	1	–
										2	14	–	–	–	–	–	–	–	–		
										3	14	1	–	–	1	–	–	1			
7	23	53 38	03 36	20	4·70	34·22	3	2	1555	1	18	–	–	1	1			1		1	–
										2	18	1	–	–	–	–	–	–	–		
										3	18	–	–	–	–	–	–	–	2		
7	24	53 45	03 20	20	4·60	34·19	3	2	1752	1	18	–	–	–	1	–	1	–	–	–	3
										2	18	–	–	–	–	1	1	1	4		
										3	18	–	–	–	1	1	1	1	–		
7	25	53 52	03 02	27	4·66	34·18	2	2	1941	1	25	–	1	–	1	3	–	2	2	1	1
										2	25	–	–	1	2	4	–	2	2		
										3	25	–	–	–	1	–	1	3	2		
7	26	54 03	03 02	20	4·66	34·25	3	3	2120	1	18	–	–	–	–	3	–	1	5	–	–
										2	18	–	–	–	–	3	–	1	1		
										3	18	–	–	–	–	1	–	3	–		
7	27	53 57	02 45	20	4·70	34·47	3	3	2303	1	18	–	–	–	4	2		2	3	–	2
										2	18	–	–	–	1	2	1	1	–		
										3	18	–	–	–	1	–	1	2	1		
8	28	54 04	02 29	33	5·02	34·54	4	4	0044	1	31	–	–	1	–	3	–	3	2	1	3
										2	31	–	–	1	2	1	2	4	2		
										3	31	1	–	1	2	1	2	3	3		
8	29	53 55	02 16	20	4·91	34·55	4	3	0247	1	18	–	–	–	–	1	–	–	2	–	1
										2	18	–	–	–	–	1	–	2	–		
										3	18	–	–	–	–	–	1	2	–		
8	30	53 46	02 03	16	4·67	34·54	4	4	0431	1	14	–	–	–	2	–	–	2	–	–	2
										2	14	–	–	–	–	–	1	–	–		
										3	14	–	–	–	–	1	1	3	–		
8	31	53 33	02 03	18	4·43	34·51	4	4	0613	1	16	–	–	–	–	1	–	2	–	1	–
										2	16	1				1	–	1			
										3	16	–	–	–	–	–	–	–	–		
8	32	53 19	02 03	17	4·36	34·44	3	3	0754	1	15	–	–	–	3	3	2	–	–	–	9
										2	15	–	–	–	1	4	3	–	–		
										3	15	–	–	–	1	2	3	–	–		
8	33	53 15	02 10	17	4·50	34·58	3	2	0843	1	15	–	–	–	–	5	3	2	1	–	6
										2	15	–	–	–	2	1	1	2	–		
										3	15	–	–	–	–	1	1	2	–		
8	34	53 12	02 19	18	4·77	34·68	2	2	0934	1	16	–	–	–	–	3	2	2	3	1	11
										2	16	–	1	–	1	2	5	4	–		
										3	16	–	–	–	–	3	3	–	–		
8	35	53 07	02 24	21	4·94	34·77	2	1	1029	1	16	–	–	–	3	2	3	–	–	–	7
										2	16	–	–	–	3	1	–	2	–		
										3	16	–	–	–	3	3	2	5	2		
8	36	53 02	02 11	21	4·86	34·70	2	1	1155	1	19	–	–	–	–	9	7	6	–	–	28
										2	19	–	–	–	–	4	5	2	–		
										3	19	–	–	–	–	10	13	3	–		
8	37	53 09	02 08	16	4·69	34·67	2	1	1301	1	14	–	–	–	1	2	1	1	–	–	9
										2	14	–	–	–	2	1	5	5	–		
										3	14	–	–	–	–	1	2	–	2		
8	38	53 16	01 56	18	4·50	34·47	2	2	1416	1	16	–	–	–	1	1	2	–	–	–	6
										2	16	–	–	–	–	2	2	–	1		
										3	16	–	–	–	–	–	1	–	1		
8	39	53 23	01 45	15	4·48	34·43	2	2	1544	1	13	–	–	–	–	1	3	–	–	–	6
										2	13	–	–	–	–	3	–	–	–		
										3	13	–	–	–	–	–	2	–	–		
8	40	53 14	01 32	14	4·50	34·44	2	2	1716	1–3	12	–	–	–	–	–	–	–	–	–	–
8	41	53 06	01 47	20	4·48	34·50	2	2	1843	1	18	–	–	–	–	–	2	–	–	–	6
										2	18	–	–	–	–	1	2	1	–		
										3	18	–	–	–	–	–	1	–	–		
8	42	52 58	02 05	15	4·72	34·70	2	2	2005	1	13	–	–	–	–	3	2	–	–	–	8
										2	13	–	–	–	–	2	1	–	–		
										3	13	–	–	–	–	–	4	2	–		
8	43	52 55	01 58	19	4·55	34·51	2	2	2050	1	17	–	–	–	–	–	–	–	–	–	1
										2	12	–	–	–	–	–	1	–	–		
										3	12	–	–	–	1	1	–	–	–		
8	44	52 55	02 22	19	4·81	34·69	2	1	2227	1	17	–	–	–	–	–	1	1	–	–	15
										2	17	–	–	–	–	4	6	5	–		
										3	17	–	–	–	–	1	6	1	–		
8	45	52 45	02 28	25	4·55	34·43	2	2	2358	1–3	23	–	–	–	–	–	–	–	–	–	–

'SIR LANCELOT'. *Cruise* 1. 1949. 5–7 *January*

Day	Station	Position °N ′	Position °E ′	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
5	1	53 26	01 06	14	7·30	34·53	3	3	2107	1–3	12½	–	–	–	–	–	–	–	–	–	–
5	2	53 33	00 49	16	7·74	34·54	4	3	2318	1–3	15	–	–	–	–	–	–	–	–	–	–
6	3	53 38	01 08	13	7·85	34·57	5	3/4	0105	1	11½	–	–	–	1	–	1	–	–	–	1
										2, 3	11½	–	–	–	–	–	–	–	–		
6	4	53 44	01 27	22	8·04	34·55	5	4/5	0257	1	19½	–	–	–	1	–	–	–	–	–	1
										2	19½	–	–	–	–	–	1	–	–		
										3	19½	–	–	–	–	–	–	–	–		
6	5	53 49	01 47	16	8·30	34·59	5	4/5	0405	1, 3	14	–	–	–	–	–	–	–	–	–	–
										2	14	–	–	1	–	–	–	–	–		
6	6	53 54	02 07	17	8·34	34·51	5	5	0627	1–3	15	–	–	–	–	–	–	–	–	–	–
6	7	54 07	01 57	30	8·34	34·58	5	5	0840	1–3	29	–	–	–	–	–	–	–	–	–	–
6	8	54 02	01 37	18	8·06	34·61	5	5	1130	1	16	1	–	–	–	–	–	–	–	1	–
										2	16	1	–	–	–	–	–	–	–		
										3	16	–	–	–	–	–	–	–	–		
6	9	53 57	01 17	18	7·99	34·61	4/5	4/5	1408	1	16	–	–	–	–	–	–	–	–	1	–
										2	16	–	1	1	–	–	–	–	–		
										3	16	–	–	1	–	–	–	–	–		
6	10	53 52	00 58	20	8·06	34·55	4	4	1600	1	18	–	–	–	–	–	1	–	–	–	1
										2	18	–	–	–	–	1	–	–	–		
										3	18	–	–	–	–	–	–	–	–		
6	11	53 47	00 39	15	7·89	34·52	4	4	1812	1–3	14	–	–	–	–	–	–	–	–	–	–
6	12	53 42	00 20	12	7·47	34·44	4	4	2055	1–3	10	–	–	–	–	–	–	–	–	–	–
6	13	53 55	00 10	18	7·14	34·42	4	3	2208	1–3	16	–	–	–	–	–	–	–	–	–	–
6	14	54 00	00 29	25	8·14	34·63	4	3/4	2343	1, 3	23	–	–	–	–	–	–	–	–	–	1
										2	23	–	–	–	–	–	1	–	–		
7	15	54 05	00 48	20	8·16	34·70	4	4	0125	1–3	18	–	–	–	–	–	–	–	–	–	–
7	16	54 10	01 07	28	8·04	34·81	4/5	4	0320	1–3	26	–	–	–	–	–	–	–	–	–	–
7	17	54 15	01 27	23	7·99	34·80	4/5	4	0501	1–3	21	–	–	–	–	–	–	–	–	–	–
7	18	54 28	01 17	28	7·91	34·78	5	4/5	0659	1–3	26	–	–	–	–	–	–	–	–	–	–
7	19	54 23	00 58	28	8·04	34·81	5	5	0930	1	25	1	–	–	–	–	–	–	–	1	–
										2	25	–	–	1	–	–	–	–	–		
										3	25	–	–	–	–	–	–	–	–		
7	20	54 18	00 39	28	8·08	34·84	5	5	1150	1	25	–	–	–	–	–	–	–	–	1	–
										2	25	1	–	–	–	–	–	–	–		
										3	25	–	–	1	–	–	–	–	–		
7	21	54 13	00 20	28	8·15	34·62	6	5/6	1523	1–3	25	–	–	–	–	–	–	–	–	–	–

'SIR LANCELOT'. *Cruise* 2. 1949. 20–26 *January*

Day	Station	Position °N ′	Position °E ′	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
20	2	53 33	00 49	11	7·24	34·57	6	5	1123	1–3	10	–	–	–	–	–	–	–	–	–	–
20	3	53 26	01 05	10	6·85	34·42	7	5/6	1447	1–3	10	–	–	–	–	–	–	–	–	–	–
21	4	53 41	01 19	12	7·41	34·57	6	5	1045	1–3	10	–	–	–	–	–	–	–	–	–	–
21	5	53 56	00 12	26	6·85	34·49	6	5	1326	1–3	24	–	–	–	–	–	–	–	–	–	–
21	6	54 08	00 00 W	24	6·36	34·43	7	6	1600	1–3	22	–	–	–	–	–	–	–	–	–	–
21	7	54 21	00 10	29	6·85	34·49	6/7	6	1938	1–3	24	–	–	–	–	–	–	–	–	–	–
21	8	54 34	00 19	28	7·24	34·87	6	6	2300	1–3	26	–	–	–	–	–	–	–	–	–	–
22	9	54 54	00 58	34	7·54	34·65	5	4	1617	1–3	31	–	–	–	–	–	–	–	–	–	–
22	10	54 59	00 38	33	7·51	34·69	5	4	1820	1–3	31	–	–	–	–	–	–	–	–	–	–
22	11	55 04	00 20 E	43	7·54	34·83	5/6	5	2040	1–3	40	–	–	–	–	–	–	–	–	–	–
22	12	55 09	00 00	37	7·41	34·88	6	5	2237	1–3	35	–	–	–	–	–	–	–	–	–	–
23	13	55 14	00 19	37	7·44	34·91	6	5	0059	1, 2	35	–	–	–	–	–	–	–	–	–	–
23	14	54 56	00 09	35	7·49	34·84	5	5	0512	1, 2	32	–	–	–	–	–	–	–	–	–	–
23	15	54 38	00 01	33	7·44	34·69	6	5	0942	1	31	–	–	–	–	–	–	–	–	–	–
										2	31	–	–	–	1	–	–	–	–		
										3	31	–	–	–	–	1	–	–	–		
23	16	54 36	00 24	32	7·49	34·79	6	5	1140	1–3	29½	–	–	–	–	–	–	–	–	–	–
23	17	54 35	00 48	35	7·41	34·87	6	5	1403	1	33	–	2	–	–	1	1	–	–	–	1
										2	33	–	–	–	–	–	–	–	–		
										3	33	–	–	–	–	1	–	–	–		
23	18	54 32	01 13	15	6·73	34·82	6	5	1608	1–3	13	–	–	–	–	–	–	–	–	–	–
23	19	54 33	01 38	10	6·89	34·86	6	5	1800	1–3	7	–	–	–	–	–	–	–	–	–	–
23	20	54 28	01 17	28	6·81	34·76	6/5	5	2019	1–3	26	–	–	–	–	–	–	–	–	–	–
23	21	54 22	00 57	30	7·41	34·70	5	5	2306	1–3	28	–	–	–	–	–	–	–	–	–	–
24	26	54 27	00 42	32	7·44	34·78	2	2	1620	1	28½	–	–	–	–	–	–	–	–	–	–
										2	28½	–	–	–	–	1	–	–	–		
24	27	54 18	00 39	32	7·46	34·75	2	2	1735	1, 3	28½	4	–	2	–	–	–	–	–	4	–
										2	28½	–	–	1	–	–	–	–	–		
25	30	54 12	00 19	31	7·36	34·60	2	2	0310	1–3	27	–	–	–	–	–	–	–	–	–	–
25	31	54 01	00 28	25	7·34	34·70	3	3	0543	1	23	2	–	1	5	1	–	–	–		
										2	23	2	–	–	4	2	–	–	–	4	1
										3	23	–	–	1	2	1	1	–	–		
25	32	54 05	00 47	21	6·96	34·64	3	3	0723	1	19	2	1	1	1	–	–	–	–		
										2	19	–	1	3	–	–	–	–	–	6	–
										3	19	1	–	2	–	–	–	–	–		
25	33	54 10	01 07	27	7·07	34·66	3	3	0935	1, 2	25	–	–	–	–	–	–	–	–		
										3	25	–	–	–	–	1	–	–	–	–	–
25	34	54 03	01 36	25	6·51	34·52	4	4	1240	1	23	6	1	1	–	–	–	–	–		
										2	23	–	–	–	–	1	–	–	–	7	–
										3	23	2	–	–	–	–	–	–	–		
25	35	53 57	01 16	21	7·14	34·58	4	4	1433	1	19	–	–	–	1	–	–	–	–		
										2	19	–	–	–	2	–	–	–	–	–	–
										3	19	–	–	–	1	–	–	–	–		
25	36	53 51	00 57	21	7·24	34·74	4	4	1615	1	19	1	–	–	4	–	–	–	–		
										2	19	–	1	–	1	–	–	–	–	2	–
										3	19	–	–	–	2	1	–	–	–		
25	37	53 47	00 38	13	7·29	34·70	4	4	1850	1–3	11	–	–	–	–	–			–	–	–
25	38	53 38	01 08	8½	6·81	34·57	5	5	2200	1–3	6	–	–	–	–	–	–	–	–	–	–
26	39	53 43	01 27	14	6·94	34·62	5	5	0006	1–3	12	–	–	–	–	–	–	–	–	–	–
26	40	53 49	01 46	14	7·24	34·60	5/4	5	0155	1, 2	12	–	–	–	–	–	–	–	–		
										3	12	–	1	–	–	–	–	–	–	1	–
26	41	54 02	01 57	41	6·41	34·62	4	4	0356	1, 2	37	–	–	–	–	–	–	–	–		
										3	37	–	–	–	–	–	1	–	–	–	1

'SIR LANCELOT'. *Cruise* 3. 1949. 4–8 *February*

Day	Station	Position N ° ′	Position E ° ′	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
4	1	53 26	01 17	7	6·14	34·62	2	2	1925	1–3	5	–	–	–	–	–	–	–	–	–	–
4	2	53 31	01 36	13	6·20	34·61	2	2	2104	1–3	11	–	–	–	–	–	–	–	–	–	–
4	3	53 35	01 56	12	6·10	34·59	2	2	2216	1–3	10	–	–	–	–	–	–	–	–	–	–
5	4	53 49	01 47	17	6·45	34·59	2	2	0027	1–3	15	–	–	–	–	–	–	–	–	–	–
5	5	53 44	01 27	16	6·37	34·61	2	2	0210	1	14	–	–	–	–	–	–	–	–	1	–
										3	14	1	–	–	–	–	–	–	–		
5	6	53 38	01 08	12	6·51	34·70	2	2	0335	1–3	10	–	–	–	–	–	–	–	–	–	–
5	7	53 33	00 48	30	6·15	34·35	2	2	0530	1–3	28	–	–	–	–	–	–	–	–	–	–
5	8	53 40	00 25	12	6·65	34·67	2	1	0800	1–3	10	–	–	–	–	–	–	–	–	–	–
5	9	53 47	00 39	18	6·67	34·75	2	1	0944	1–3	17	–	–	–	–	–	–	–	–	–	–
5	10	53 52	00 57	24	6·74	34·60	2	1	1121	1	22	–	1	–	1	–	1	–	–		
										2	22	1	–	1	1	–	–	–	–	4	1
										3	22	2	–	–	1	–	–	1	–		
5	11	53 57	01 16	18	6·33	34·56	2	1	1311	1	16	–	–	–	2	1	–	–	–	–	
										2, 3	16	–	–	–	–	–	–	–	–		
5	12	54 02	01 36	20	6·69	34·55	2	2	1441	1	18	–	–	–	–	1	–	–	–		
										2	18	3	1	–	1	1	–	–	–	4	–
										3	18	–	–	–	1	–	–	–	–		
5	13	54 07	01 55	30	6·42	34·59	2	2	1622	1	28	–	–	–	–	1	1	1	–		
										2	28	–	–	2	1	1	1	2	2	–	3
										3	28	–	–	–	1	2	1	5	6		
5	14	53 54	02 05	15	6·35	34·52	2	2	1836	1	13	–	–	–	–	–	–	–	–		
										2	13	–	–	–	2	–	–	–	–	2	–
										3	13	–	2	–	–	–	–	1	–		
5	15	53 46	02 33	15	6·62	34·58	3	3	2101	1	13	1	1	1	1	2	1	–	–		
										2	13	1	–	1	–	–	–	–	–	8	1
										3	13	2	2	1	1	–	–	1	–		
5	16	53 59	02 24	34	6·75	34·58	3	3	2254	1	32	1	1	1	4	4	2	6	4		
										2	32	2	1	1	4	4	5	1	1	7	7
										3	32	1	1	–	2	3	–	2	–		
6	17	54 06	02 19	28	6·73	34·57	2	2	0042	1	26		–	–	1	9	7	2	2		
										2	26	–	1	–	2	6	4	–	1	2	17
										3	26	–	1	–	1	8	6	2	1		
6	18	54 12	02 14	17	6·23	34·54	2, 1	1	0157	1	15	–	1	1	–	1	1	–	–		
										2	15	–	–	1	1	1	–	–	–	1	1
										3	15	–	–	–	–	–	–	–	–		
6	19	54 20	01 45	22	5·90	34·65	1	1	0421	1	20	–	–	–	2	–	–	–	–		
										2, 3	20	–	–	–	–	–	–	–	–	–	–
6	20	54 15	01 27	23	6·35	34·58	1	1	0559	1–3	21	–	–	–	–	–	–	–	–	–	–
6	21	54 10	01 07	27	6·39	34·54	2	2	0739	1	24	–	1	1	–	–	1	–	–		
										2	24	–	–	–	–	–	–	1	–	1	1
										3	24	–	–	–	1	–	–	–	–		
6	22	54 05	00 48	27	6·12	34·54	3	3	0915	1	24	2	–	6	6	–	–				
										2	24	–	1	3	2	–	1	–	–	4	1
										3	24	–	1	2	1	–	–	1	–		
6	23	54 00	00 29	27	6·93	34·79	3	3	1136	1	25		–	4	2	3	3	–			
										2	25	–	1	2	2	3	3	–	–	1	10
										3	25	–	–	1	1	3	4	–	–		
6	24	53 56	00 14	24	6·15	34·44	4	3/4	1308	1–3	22	–	–	–	–	–	–	–	–	–	–
6	25	54 08	00 00	22	5·75	34·44	4	3	1455	1–3	20	–	–	–		–	–	–	–	–	
6	26	54 13	00 19	26	6·98	34·67	4	4	1633	1	24	1	4	1	10	1	2	–	–		
										2	24	1	–	3	6	1	2	–	–	7	3
										3	24	1	2	4	11	2	–	–	–		
6	27	54 26	00 10	32	6·98	34·63	4	4	1823	1	30	–	–	–	–	–	–	–	–		
										2	30	–	–	1	1	–	–	–	–	–	–
										3	30	–	–	–	2	–	–	–	–		
6	28	54 31	00 29	29	7·08	34·79	4	4	2015	1, 3	27	–	–	–	–	–	–	–	–		
										2	27	–	–	–	1	–	–	–	–	–	–
6	29	54 18	00 39	27	6·94	34·54	5	4/5	2300	1	25	–	–	1	–	–	1	–	–		
										2	25	–	–	–	–	–	–	–	–	1	1
										3	25	1	–	–	–	–	1	–	–		
7	30	54 23	00 57	27	6·45	34·61	5	5	0100	1	24½	–	–	–	–	–	–	1	–		
										2	24½	–	–	–	–	–	–	–	–	–	–
										3	24½	–	–	–	1	–	–	–	–		
8	38	54 20	02 08	15	6·00	34·55	5	5	1540	1	13	–	–	–	1	–	1	–	–		
										2	13	–	–	–	2	–	–	–	1	–	1
										3	13	–	–	–	–	1		–	–		
8	39	54 17	02 35	14	6·11	34·54	4	4/5	1726	1	12	2	–	2	1	3	1	–	–		
										2	12	1	–	–	1	–	1	–	–	3	2
										3	12	–	1	–	1	–	1	–	–		
8	40	54 09	02 40	31	6·56	34·65	4/5	4/5	1846	1	29	–	–	5	1	6	1	–	–		
										2	29	–	–	5	5	4	1	–	–	1	1
										3	29	–	1	2	5	4	–	–	–		
8	41	54 01	02 46	33	6·45	34·57	5	5	2011	1	30	–	1	1	–	–	1	–	1		
										2	30	–	–	–	–	–	–	–	3	1	1
										3	30	–	–	–	–	–	1	–	–		
8	42	54 07	03 06	21	6·27	34·60	5	5	2218	1	18½	–	1	–	5	3	4	1	–		
										2	18½	–	–	4	5	–	–	2	4	1	3
										3	18½	1	–	2	6	1	–	–	3		
8	43	54 14	02 59	23	6·45	34·58	6	5/6	2353	1	20	–	–	–	4	2	–	–	–		
										2	20	–	–	–	–	–	1	–	–	–	1
										3	20	–	–	–	3	3	–	1	1		

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Day	Station	Position N ° ′	Position E ° ′	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
19	1	53 41	01 17	16	6·10	34·56	4	3	2130	1, 3	14	–	–	–	–	–	–	–	–	–	–
										2	14	–	–	–	–	1	–	–	–		
20	2	54 03	01 35	35	6·05	34·69	3	3	0031	1–3	33			–	–	–	–	–	–	–	–
20	3	53 57	01 16	21	6·24	34·58	5	4	0322	1	19	–		–	–	–	–	1	–		
										2	19	–	–	–	–	–	1	1	1	–	1
										3	19	–	–	–	–	–	–	1	–		
20	4	53 51	00 56	19	5·97	34·57	5	5	0441	1	17	–	–	2	2	–	–	–	–		
										2	17	–	–	–	–	–	2	–	–	–	1
										3	17	–	–	1	1	1	–	–	–		
20	5	53 47	00 38	17	6·00	34·68	6	5	0657	1–3	15	–	–	–	–	–	–	–	–	–	–
20	6	53 56	00 14	26	5·70	34·41	5	4/5	0909	1–3	24	–	–	–	–	–	–	–	–	–	–
20	7	54 00	00 29	27	6·76	34·66	5	4 5	1034	1	25	–	1	7	9	4	3	–	1		
										2	25	–	–	8	6	11	4	–	–	1	9
										3	25	–	–	4	3	6	6	1	–		
20	8	54 05	00 47	27	6·46	34·62	5	5	1226	1, 2	25	–	–	–	–	–	–	–	–	–	–
										3	25	–	–	–	–	–	–	–	1		
20	9	54 10	01 07	28	6·39	34·61	5	5	1430	1, 2	26	–	–	–	–	–	–	–	–	1	–
										3	26	–	1	–	–	1	–	–	1		
20	10	54 15	01 27	20	5·85	34·68	5	5	1605	1	18	–	–	–	–	–	1	–	–		
										2	18	–	–	–	–	–	2	–	–	–	2
										3	18	–	–	–	–	–	–	–	–		
20	11	54 33	01 37	9	5·95	34·71	5	5	1747	1	7	–	–	–		–	1	–	–		
										2, 3	7	–	–	–	–	–	–	–	–	–	1
20	12	54 28	01 17	24	6·36	34·73	4	5/4	1943	1, 2	22	–	–	–	–	–	–	–	–		
										3	22	–	–	–	–	–	2	–	–	–	1
20	13	54 23	00 58	20	6·61	34·70	4	4	2200	1	18	–	–	–	–	–	1	–	–		
										2, 3	18	–	–	–	–	–	–	–	–	–	1
21	14	54 18	00 38	29	6·91	34·71	4	4	0033	1	27	3	1	6	4	–	1	–	–		
										2	27	–	–	4	4	2	–	–	–	5	1
										3	27	1	1	3	4	2	–	–	–		
21	15	54 13	00 19	29	6·41	34·57	3	3	0258	1–3	27	–	–	–	–	–	–	–	–	–	–
22	19	54 08	00 00 W	25	5·90	34·43	5/6	4	0951	1–3	23	–	–	–	–	–	–	–	–	–	–
22	20	54 20	00 09	27	5·90	34·59	5/6	4/5	1215	1–3	25	–	–	–	–	–	–	–	–	–	–
24	21	55 04	00 46	34	6·78	34·67	5/6	5	1035	1	32	–	1	–	1	–	–	–	–	2	–
24	22	55 07	00 13 E	40	6·84	34·85	5/6	5	1250	1	38	1	–	–	–	–	–	–	–	2	–
24	23	55 11	00 22	40	6·75	34·93	5/6	5	1517	1	38	–	–	–	–	–	–	–	–	–	–
24	24	55 15	00 56	30	6·71	34·95	5	5	1735	1	28	–	–	–	–	–	–	–	–	–	–
24	25	55 18	01 28	28	6·71	34·99	6	6	1750	1	26	1	1	3	3	1	–	–	–	4	–
24	26	54 59	01 20	15	6·71	34·90	7	6	2238	1	13	–	–	–	–	–	–	–	–	–	–
25	27	54 40	01 09	20	6·81	34·78	8	7	0208	1	18	–	–	–	1	1	–	–	1		
										2	18	–	–	–	–	–	–	–	–	–	–
										3	18	–	–	–	1	–	–	–	–		
25	28	54 35	00 48	30	6·83	34·78	8	8	0420	1	28	1	–	–	–	1	–	–	–		
										2	28	–	–	–	2	–	1	–	–	0	0
										3	28	–	–	2	–	3	–	–	–		
25	29	54 30	00 28	30	6·81	34·83	7/8	6/7	0705	1	28	1	1	3	–	1	1	–	–		
										2	28	1	3	–	1	1	–	–	–	4	0
										3	28	1	1	1	2	–	–	–	–		
25	30	54 25	00 09	31	6·79	34·71	6	5/6	1037	1	29	–	–	1	–	–	–	–	1		
										2	29	–	–	–	–	–	1	–	–	–	1
										3	29	–	–	1	2	1	–	–	–		
25	31	54 37	00 01	31	6·81	34·78	5	5	1140	1	29	1	2	–	–	2	–	–	–		
										2	29	–	–	–	–	1	1	–	–	2	1
										3	29	–	–	–	3	–	–	–	–		
25	32	54 43	00 20	35	6·81	34·84	5	5	1342	1, 3	33	–	–	–	–	–	–	–	–		
										2	33	–	–	–	1	–	–	–	–	–	–
25	33	54 47	00 40	42	6·83	34·88	5	4	1540	1–3	40	–	–	–	–	–	–	–	–	–	–
25	34	54 16	01 48	20	6·10	34·73	5	5	2217	1–3	18	–	–	–	–	–	–	–	–	–	–
26	35	54 07	01 55	27	6·12	34·70	6	5/6	0012	1–3	25	–	–	–	–	–	–	–	–	–	–
26	36	53 54	02 04	15	6·10	34·51	7	6	0240	1	13	–	–	–	–	–	–	–	2		
										2	13	–	–	–	–	–	–	–	–	–	–
										3	13	–	–	–	–	–	–	–	1		
26	37	53 59	02 23	32	6·10	34·69	7	6	0450	1	30	1	1	7	7	–	–	–	–		
										2	30	–	1	4	2	2	–	–	1	3	–
										3	30	2	1	4	3	–	–	–	–		
26	38	54 12	02 14	17	6·15	34·79	7	7	0730	1	15	1	–	–	–	–	–	–	–		
										2, 3	15	–	–	–	–	–	–	–	–	1	–
26	39	54 17	02 35	14	6·05	34·88	7	7	0922	1	12	2	1	–	–	–	–	–	–		
										2	12	–	–	–	–	–	–	–	–	2	–
										3	12	–	–	–	1	–	–	–	–		
26	40	54 04	02 45	32	6·46	34·60	8	7/8	1137	1	30	–	–	4	6	4	2	–	1		
										2	30	–	–	1	–	–	–	–	1	–	1
										3	30	–	–	–	–	–	–	1	2		
26	41	53 51	02 54	25	6·66	34·57	8	7/8	1412	1, 2	23	–	–	–	–	–	–	–	–	–	–
										3	23	–	–	–	–	–	–	1	–		
26	42	53 39	03 03	18	6·31	34·55	7/8	7	1625	1, 2	16	–	–	–	–	–	–	–	–	–	–
										3	16	–	–	1	–	–	–	–	–		

'SIR LANCELOT'. *Cruise* 5. 1949. 12–18 *March*

Day	Station	Position °N,	Position °E,	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
12	7	53 32	01 35	14	5·20	34·60	6	5	1010	1–3	12	–	–	–	–	–	–	–	–	–	–
12	8	53 31	01 29	13	5·18	34·69	6/7	5	1150	1	11	–	–	–	–	–	–	–	1		
										2	11	–	–	–	–	–	–	–	1	–	–
										3	11	–	–	–	–	–	–	1	–		
12	9	53 45	01 09	13	4·82	34·61	4	4	1436	1–3	10½	–	–	–	–	–	–	–	–	–	–
12	10	53 47	00 38	18	5·44	34·36	3	4	1727	1	16¼	–	–	–	–	–	–	1	–	–	–
										2, 3	16¼	–	–	–	–	–	–	–	–		
12	11	53 51	00 57	22	5·47	34·64	3	3	1908	1	20					1	–	1	1		
										2	20	–	–	–	–	1	1	–	–	–	1
										3	20	–	–	–	–	–	–	–	–		
12	12	53 57	01 16	20	5·39	34·71	3	3	2043	1	18	–	–	1	–	–	–	–	–		
										2	18	–	–	–	1	–	–	–	1	–	–
										3	18	–	–	1	–	–	–	–	1		
12	13	54 02	01 34	40	5·54	34·71	3	3	2212	1	38	–	–	–	–	–	–	1	–		
										2	38	–	–	–	–	–	–	–	–	–	–
										3	38	–	–	–	–	1	–	–	–		
13	14	54 15	01 26	24	5·49	34·76	5	5	0005	1–3	22	–	–	–	–	–	–	–	–	–	–
13	15	54 10	01 07	28	5·59	34·67	5	5	0235	1	26	–	–	–	–	–	–	–	1		
										2	26	–	–	–	–	–	–	–	–	–	–
										3	26	–	–	–	1	–	–	–	–		
13	16	54 05	00 47	26	5·77	34·71	6	5	0518	1	23	–	–	–	–	1	–	–	–		
										2, 3	23	–	–	–	–	–	–	–	–	–	–
13	17	54 00	00 28	28	5·49	34·54	7	6	0825	1–3	26	–	–	–	–	–	–	–	–	–	–
13	18	53 56	00 11	25	5·49	34·56	7	5	1021	1	22	–	–	–	–	–	1	–	–		
										2	22	–	–	–	–	–	1	–	–	–	2
										3	22	–	–	–	1	1	1	–	–		
13	19	54 08	00 00	25	4·87	34·51	7	4	1211	1–3	23	–	–	–	–	–	–	–	–	–	–
13	20	54 13	00 19	30	5·68	34·59	7	5	1408	1–3	28	–	–	–	–	–	–	–	–	–	–
13	21	54 26	00 09	33	6·07	34·72	5	5	1712	1	31	–	–	–	–	–	1	–	–		
										2	31	–	–	–	–	1	1	–	–	–	1
			W							3	31	–	–	–	–	1	–	–	–		
13	22	54 21	00 10	29	5·84	34·57	7	5	1919	1–3	27	–	–	–	–	–	–	–	–	–	–
13	23	54 34	00 19	30	6·04	34·68	7	6	2125	1	28	1	–	–	–	–	–	–	–		
										2	28	–	–	–	–	–	–	1	–	1	1
										3	28	–	–	–	1	–	1	–	–		
14	24	54 54	00 54	42	6·09	34·65	3	3	1330	1–3	38	–	–	–	–	–	–	–	–	–	–
14	25	54 46	00 27	35	6·10	34·74	4	4	1535	1	33	2	1	1	1	2	–	–	–		
										2	33	–	–	3	2	2	–	–	–	2	–
										3	33	–	–	1	1	1	–	–	–		
14	26	54 59	00 37	35	6·16	34·73	4	4	1836	1	33	–	1	1	4	–	–	–	–		
										2	33	1	1	1	–	3	–	–	–	4	–
										3	33	2	–	–	2	2	–	–	–		
14	27	55 12	00 45	41	6·23	34·74	5	5	2047	1–3	35	–	–	–	–	–	–	–	–	–	–
14	28	55 04	00 19	45	6·14	34·85	6	5/6	2323	1	35	–	–	1	–	–	–	–	–		
										2	35	–	–	–	–	–	–	1	–	–	–
			E							3	35	–	–	–	–	–	–	–	–		
15	29	55 09	00 02	38	6·09	34·92	7	6	0133	1, 2	35	–	–	–	–	–	–	–	–	–	1
										3	35	–	–	–	–	–	1	–	–		
15	30	54 55	00 10	35	6·17	34·90	7	7	0341	1	33	1	–	–	–	1	–	–	–	1	–
16	35	54 01	00 33	25					0148	1	24	–	–	–	–	–	–	–	–	–	–
16	37	54 04	00 47	27					1037	1	25	–	–	–	–	–	–	–	–	–	–
16	39	54 11	00 33	30			6/7	6/7	2041	1	28	6	2	1	1	1	–	–	–		
										2	28	9	5	1	1	1	–	–	–	18	1
										3	28	7	4	–	2	–	1	–	–		
16	40	54 18	00 38	30	5·97	34·69	6	6	2254	1	30	–	–	2	8	4	4	1	–		
										2	28	1	–	1	3	5	–	2	–	1	3
										3	28	–	1	2	4	2	1	–	–		
17	41	54 31	00 29	32	6·08	34·79	6	6	0051	1	30	–	1	–	1	–	–	–	–		
										2	30	2	1	–	–	–	1	1	1	4	2
										3	30	2	–	–	2	–	2	–	–		
17	42	54 35	00 48	33	5·99	34·80	6	6	0252	1	31	–	–	–	–	–	1	1	–		
										2	31	–	–	–	2	–	–	1	–	–	1
										3	31	–	–	–	–	–	1	–	–		
17	43	54 23	00 57	21	5·80	34·78	6	6	0442	1, 2	19	–	–	–	–	–	–	–	–	–	–
										3	19	–	–	–	–	–	–	1	–		
17	44	54 28	01 17	30	5·63	34·83	5	5	0644	1–3	28	–	–	–	–	–	–	–	–	–	–
17	45	54 34	01 39	11	5·14	35·01	3	4	0917	1–3	9	–	–	–	–	–	–	–	–	–	–
17	46	54 25	01 53	13	5·31	34·90	6	5	1130	1, 2	12	–	–	–	–	–	–	–	–	–	–
17	47	54 17	02 08	16	5·31	34·77	5/6	5	1326	1–3	14	–	–	–	–	–	–	–	–	–	–
17	48	54 12	02 21	17	5·28	34·77	6	5/6	1454	1	15	–	–	–	–	–	–	1	–		
										2, 3	15	–	–	–	–	–	–	–	–	–	–
17	49	54 06	02 33	32	5·45	34·63	6/7	7	1631	1	30	–	–	1	–	–	–	4	2		
										2	30	–	–	–	1	–	1	–	1	–	0
										3	30	–	–	1	–	–	–	–	–		
17	50	54 00	02 44	24	5·35	34·54	7	7	1806	1	22	–	–	–	1	1	–	–	–		
										2	22	–	–	–	–	–	–	–	1	–	0
										3	22	–	–	–	–	1	1	1	–		
17	51	53 50	03 03	20	5·41	34·51	8	7/8	1955	1	18	–	–	–	–	–	–	1	–		
										2	18	–	–	–	–	–	–	–	–	–	1
										3	18	–	–	–	–	–	2	–	1		
17	52	53 41	05 20	20	5·24	34·51	8	7/8	2140	1	18	–	1	–	–	1	1	–	–		
										2	18	–	–	–	1	2	1	–	–	0	1
										3	18	–	–	–	–	2	1	–	–		
17	53	53 32	03 39	16	5·01	34·50	8	7/8	2322	1	11	–	–	1	–	–	–	–	–		
										2	11	–	–	–	2	1	–	–	–	–	–
										3	11	–	–	–	1	–	–	–	–		
18	54	53 21	03 58	13	5·03	34·50	8	7/8	0053	1	10	–	–	–	–	–	–	–	–		
										2	10	–	–	–	1	–	–	–	–	–	0
										3	10	–	–	–	–	–	1	–	–		

'SIR LANCELOT'. *Cruise* 6. 1949. 10–16 *April*

Day	Station	Position °N,	Position °E,	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
10	1	54 08	00 00	26	6·5	34·42	3	3	0727	1, 2	23	–	–	–	–	–	–	–	–	–	–
10	2	54 12	00 19	29	6·5	34·67	3	3	0920	1, 2	27	–	–	–	–	–	–	–	–	–	–
10	3	54 18	00 38	30	6·0	34·71	4/5	4	1105	1, 2	28	–	–	–	–	–	–	–	–	–	–
10	4	54 24	00 58	26	6·5	34·79	5	5	1255	1, 2	26	–	–	–	–	–	–	–	–	–	–
10	5	54 29	01 17	18	6·0	34·98	5	5	1440	1, 2	18	–	–	–	–	–	–	–	–	–	–
10	6	54 34	01 38	10	6·0	35·16	5	5	1555	1, 2	10	–	–	–	–	–	–	–	–	–	–
11	7	55 31	03 23	21	6·0	35·16	5/6	5	1645	1	19	–	–	–	–	–	–	–	–	–	–
11	8	55 25	03 00	18	6·0	35·00	6	5/6	0800	1	18	–	–	–	–	–	–	–	–	–	–
11	9	55 20	02 35	19	6·0	35·07	6/7		1100	1	17	–	–	–	–	–	–	–	–	–	–
11	10	55 14	02 12	13	6·0	35·03	7	6	1440	1	11	–	–	–	–	–	–	–	–	–	–
11	11	55 07	01 48	18	6·5		6	5	1730	1	16	–	–	–	–	–	–	–	–	–	–
11	12	55 01	01 24	17	6·5	34·92	5	5	2005	1	15	–	–	–	–	–	–	–	–	–	–
11	13	54 55	01 00	30	6·5	34·86	5	5	2250	1	28	–	–	–	–	–	–	–	–	–	–
12	14	54 49	00 36	42	6·5	34·83	5	5	0130	1	40	–	–	–	–	–	–	–	1	–	–
12	15	54 43	00 13 *W*	36	6·5	34·82	4	4	0410	1	36	–	–	–	–	1	2	–	–	–	4
12	16	54 36	00 10	31	6·5	34·72	3	3	0635	1	31	1	1	1	7	4	10	–	–	6	30
12	17	54 54	00 48	33	6·5	34·62	2	2	2035	1	31	–	1	2	3	1	–	2	–	3	–
12	18	54 59	00 29	35	6·5	34·86	Airs	2/1	2110	1	33	–	–	–	–	1	1	–	–	–	3
13	19	55 05	00 04 *E*	37	6·5	34·82	2	1	0045	1	35	–	–	–	–	–	–	–	–	–	–
13	20	55 11	00 21	47	6·5	34·89	2	1	0245	1	44	–	–	–	–	–	–	–	–	–	–
13	21	55 17	00 44	40	6·5	34·94	3/4	3	0500	1	38	–	–	–	–	–	–	–	–	–	–
13	22	55 23	01 10	39	6·5	34·98	4	3	0705	1	37	–	–	–	–	–	–	–	–	–	–
13	23	55 29	01 34	42	6·5	34·98	4	3	0905	1	40	–	–	–	–	–	–	–	–	–	–
13	24	55 35	01 59	42	6·5	34·98	4	3	1100	1	40	–	–	–	–	–	–	–	–	–	–
13	25	55 58	01 41	44	6·5	34·98	4/5	4	1410	1	42	–	–	–	–	–	–	–	–	–	–
13	26	55 52	01 16 *W*	43	6·5	34·99	4/5	4	1700	1	41	–	–	–	–	–	–	–	–	–	–
14	27	55 16	01 07	49	7·4	34·49	3	2	1615	1	45	–	–	–	–	–	–	–	–	–	–
14	28	55 21	00 48	52	7·0	34·77	2/3	2	1803	1	45	–	–	1	–	–	–	–	–	–	–
14	29	55 27	00 23 *E*	34	7·0	34·79	2/3	2	2007	1	32	–	–	–	–	–	–	–	–	–	–
14	30	55 34	00 01	34	7·0	34·79	2	2	2235	1	34	–	–	–	–	–	–	–	–	–	–
15	31	55 40	00 27	42	7·0	34·85	2	2	0025	1	42	–	–	–	–	–	–	–	–	–	–
15	32	55 47	00 51	37	7·0	34·92	2	2	0225	1	35	–	–	–	–	–	–	–	–	–	–
15	33	56 10	00 32	50	7·0	34·87	3	2	0615	1	48	–	–	–	–	–	–	–	–	–	–
15	34	56 36	00 16 *W*	44	6·5	34·69	3	2	0905	1	42	–	–	–	–	–	–	–	–		
15	35	56 26	00 10 *E*	47	6·5	34·61	3	3	1150	1	45	–	–	–	–	–	–	–	–	–	–
15	36	56 03	00 09 *W*	47	7·0	34·96	4	3	1450	1	45	–	–	–	–	–	–	–	–	–	–
15	37	55 54	00 16	40	7·0	34·84	5	5	1720	1	38	–	–	–	–	–	–	–	–	–	–
15	38	56 20	00 35	40	6·5	34·43	5	5	2025	1	40	–	–	–	–	–	–	–	–	–	–
15	39	56 14	01 00	35	6·0	34·40	5	5	2240	1	38	–	–	–	–	–	–	–	–	–	–
16	40	55 50	00 41	35	6·5	34·62	4	4	0320	1	35	–	–	–	–	–	–	–	–	–	–
16	41	55 45	01 06	39	6·5	34·67	4	4	0530	1	38	–	–	–	–	–	–	–	–	–	–
16	42	55 38	01 27	27	6·5	34·32	3/4	4	0725	1	25	–	–	–	–	–	–	–	–	–	–

'SIR LANCELOT'. *Cruise* 1. 1950. 2–5 *January*

Day	Station	Position N,	Position E,	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: 1 per m²	V per m²
2	1	52 19	02 07	18	7·6	35·00	5	4	1055	1–3	16	–	–	–	–	–	–	–	–	–	–
2	2	52 12	02 24	23	9·3	35·23	5	4/5	1308	1–3	20	–	–	–	–	–	–	–	–		
2	3	52 03	02 10	18	9·6	35·23	4	3/4	1555	1–3	15	–	–	–	–	–	–	–	–	–	–
2	4	51 48	02 14	24	9·9	35·25	3	4/3	2235	1	22	2	1	1	–	–	1	–	–		
										2	22	2	1	–	–	–	–	–	–	16	1
										3	22	5	2			–			–		
3	5	51 40	02 00	23	10·2	35·26	3	3	0106	1	21	2	2	2			3	–	–		
										2	21	1	1	1	1	–	–	–	–	8	4
										3	21	–	–	1	–	–	–	–	–		
3	6	51 22	02 00	19	10·3	35·27	2	2	0350	1	16	2	1	–	–	–	–		–		
										2	16	1	3	–	–	–	–	–	–	18	
										3	16	3	1	–	–	2	–	–	1		
3	7	51 22	02 28	14	8·6	34·97	2	2	0612	1–3	12	–	–	–	–	–	–	–	–	–	–
3	8	51 32	02 15	18	9·9	35·27	2	2	0811	1	16	1	1	–		–	–	–	–		
										2	16	–	–	–	2	–	–	–	–	3	2
										3	16	–	–	2	1	–	1	–	1		
3	9	51 41	02 29	16	9·4	35·22	2	2	1002	1	14	4	1	3	–	1	–	–	1		
										2	14	–	2	1	–	2	–	–	–		
										3	14	1	2	3	3	–	1	–	–	16	3
										4	14	–	1	1	1	1	1	–	–		
										5	14	2	1	4	2	–	1	–	–		
3	10	51 37	02 43	17	9·2	35·13	2	2	1350	1–3	13	1	1	–	–	–	–	–	–	4	–
3	11	51 43	02 58	17	8·7	35·08	2	2	1532	1	15½	–	–	4	–	–	–	–	–		
										2	15½	2	–	–	1	–	–	–	–	3	–
										3	15½	–	–	–	–	1	–	–	–		
3	12	51 50	02 43	19	9·3	35·19	2	2	1657	1	17	1	2	1	1	2	–	1	–		
										2	17	–	2	2	3	–	–	–	–	14	2
										3	17	1	3	1	2	1	1	1	–		
3	13	51 57	02 27	20	9·7	35·25	2	2	1849	1	18	–	7	4	5	2	4	–	–		
										2	18	3	2	2	3	4	–	–	1	29	6
										3	18	3	3	2	1	2	–	–	–		
3	14	52 05	02 40	22	9·6	35·26	Airs	2	2042	1	20	2	–	1	–	4	–	1	–		
										2	20	4	1	1	1	5	2	1	1	10	3
										3	20	–	–	3	1	1	–	–	–		
3	15	51 58	02 56	17	9·1	35·22	Airs	2	2237	1	15	2	3	2	2	1	–	1	1		
										2	15	2	–	1	1	1	–	–	–	13	–
										3	15	2	–	2	3	–	–	–	–		
4	16	51 51	03 12	15	8·2	35·08	Airs	1	0012	1–3	13	2	2	–	–	–	–	–	1	7	–
4	17	52 00	03 26	13	7·3	34·87	2	1/2	0151	1–3	11	–	–	–	–	–	–	–	–	–	–
4	18	52 07	03 10	16	8·5	35·12	3	3	0334	1	13½	2	–	–	–	1	–	–	–		
										2	13½	1	2	1	–	–	1	–	–	10	1
										3	13½	1	1	–	–	–	–	–	–		
4	19	52 14	02 53	19	9·3	35·26	2	2	0526	1	16	1	2	2	–	1	–	–	–		
										2	16	3	–	4	4	–	–	–	–	15	–
										3	16	2	1	–	1	1	–	–	–		
4	20	52 21	02 37	22	9·6	35·23	2	2	0701	1	20	1	1	–	1	1	–	–	–		
										2	20	2	–	1	–	–	–	–	–	8	–
										3	20	–	1	–	–	–	–		–		
4	21	52 29	02 50	22	9·5	35·31	2	2	0927	1	19	1	4	3	–	1	–	–	–		
										2	19	–	–	1	1	–	–	–	–	12	1
										3	19	1	1	1	1	–	1	–	–		
4	22	52 36	02 34	22	9·1	35·23	3	3	1111	1–3	19½	1	–	–	–	–	–	–	–	2	–
4	23	52 45	02 47	19	9·4	35·26	2	2	1305	1	17	1	1	–	–	1	1	–	–		
										2	17	–	–	1	1	–	–	–	–	4	2
										3	17	–	–	–	1	–	–	–	–		
4	24	52 38	03 03	15	9·1	35·17	Airs	2	1453	1	12	1	1	1	1	1	1	–	–		
										2	12	4	1	–	2	1	1	–	–	18	4
										3	12	–	2	3	2	–	–	–	1		
4	25	52 31	03 18	12	8·6	35·13	2	2	1642	1	12	2	–	2	–	1	–	–	–		
										2	12	1	2	1	–	1	–	–	–	9	–
										3	12	1	–	1	2	1	–	–	–		
4	26	52 22	03 06	22	9·0	35·20	5	4	1826	1	20	1	2	2	4	2	1	–	–		
										2	20	1	1	3	5	1	1	1	1	6	2
										3	20	1	–	4	3	2	–	–	–		
4	27	52 15	03 22	15	8·4	35·09	5	4	2019	1	13	3	–	–	–	–	2	–	–		
										2	13	1	–	3	1	1	–	1	–	9	2
										3	13	3	2	–	1	–	–	–	1		
4	28	52 08	03 37	14	7·7	34·97	4	4	2140	1	12	–	–	–	1	–	–	–	–		
										2	12	–	–	–	1	1	–	–	–	–	–
										3	12	–	–	–	–	–	–	–	–		
4	29	52 18	03 50	10	7·7	35·08	4	4	2334	1–3	8	–	–	–	–	–	–	–	–	–	–
5	30	52 24	03 35	13	8·2	35·07	4	4	0127	1	11	1	–	1	–	–	–	–	–		
										2	11	1	–	1	–	–	–	–	–	2	–
										3	11	–	–	–	–	–	–	–	–		
5	31	52 33	03 48	13	7·8	35·04	4	4	0318	1–3	11	1	–	–	2	–	–	–	–	1	–
5	32	52 40	03 32	14	8·3	35·13	4	4	0526	1–3	13	1	1	1	1	–	–	1	–	1	–
5	33	52 46	03 16	13	8·8	35·23	5	4	0738	1	10½	–	–	2	1	1	–	–	2		
										2	10½	–	1	1	–	1	1	–	–	5	1
										3	10½	1	2	3	1	2	–	–	1		
5	34	52 53	03 01	14	9·2	35·31	5	4/5	0948	1	12	1	–	–	–	3	1	–	–		
										2	12	1	1	1	–	–	–	–	–	6	2
										3	12	1	1	2	1	1	1	–	–		
5	35	53 01	02 44	19	8·4	35·11	4	4	1207	1	17½	1	–	1	–	–	–	–	–		
										2	17½	–	–	1	–	1	–	–	–	1	1
										3	17½	–	–	–	–	–	1	–	–		
5	36	53 09	02 57	16	8·4	35·14	4	4	1330	1	14	–	–	1	3	1	–	–	–		
										2	14	–	3	1	1	1	1	–	–	12	1
										3	14	3	2	3	–	2	–	–	–		
5	37	53 16	02 41	15	7·4	34·52	4/5	4/5	1521	1–3	13	–	–	3	–	–	–	–	–	–	–
5	38	53 25	02 55	16	7·1	34·43	5	5	1700	1–3	14	1	1	4	2	–	1	–	–	2	1
5	39	53 18	03 11	14	8·1	34·97	5	5	1849	1–3	12	5	4	–	1	1	1	–	–	10	1
5	40	53 11	03 28	14	8·6	35·24	6	5/6	2014	1–3	12	2	5	3	3	2	1	–	–	7	1
5	41	52 57	03 26	13			6	6	2246	1–3	11	–	–	1	–	2	–	–	–	–	–

'SIR LANCELOT'. *Cruise* 2. 1950. 18–22 *January*

Day	Station	Position °N,	Position °E,	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
18	7	53 37	02 42	18	6·62	34·43	3/4	3/4	1950	1	17	1	2	–	–	–	–	–	–		
										2	17	–	4	1	–	–	–	–	–	6	–
										3	17	..	.	.				.	.		
18	8	53 25	02 55	15	6·45	34·38	3	3	2135	1	12½	2	3	1	3	5	–	–	–		
										2	12½	2	–	3	7	1	1	–	–	14	1
										3	12½	3	2	–	1	3	–	–	–		
18	9	53 16	02 40	14	6·72	34·43	2	2	2322	1	12	–	1	1	2	–	–	–	–		
										2	12	2	2	–	5	–	–	–	–	13	–
										3	12	4	2	1	1	2	–	–	–		
19	10	53 09	02 57	16	7·46	34·83	4	3/4	0100	1	14	1	–	1	5	3	–	–	–		
										2	14	–	1	2	2	1	–	–	–	3	–
										3	14	1	–	3	–	3	–	–	–		
19	11	53 01	02 44	18	7·44	34·84	4	3.4	0230	1	16	3	–	–	–	–	–	–	–		
										2	16	1	1	–	–	–	–	–	–	5	–
										3	16	–	1	1	1	–	–	–	–		
19	12	52 52	02 31	19	7·44	34·86	4	3/4	0407	1–3	17	–	–	–	–	–	–	–	–	–	–
19	13	52 36	02 34	23	7·63	35·01	5	4/5	1417	1–3	21	–	–	–	–	–	–	–	–	–	–
19	14	52 45	02 48	19	8·44	35·19	5	5	1622	1	17	1	2	2	1	1	3	–	–		
										2	17	1	2	–	1	1	–	–	–	8	3
										3	17	2	3	1	4	3	1	–	–		
19	15	52 56	03 01	13	8·54	35·28	5	5	1838	1	10	1	1	2	2	1	2	3	1		
										2	10	–	–	3	2	–	2	4	2	2	4
										3	10	–	–	1	4	2	1	2	3		
19	16	53 02	03 14	16	8·30	35·26	5	5	2047	1	14	1	1	4	7	3	6	1	1		
										2	14	4	1	4	3	3	1	–	1	6	6
										3	14	2	–	8	5	2	2	–	1		
19	17	53 11	03 28	14	8·14	35·28	5	5	2312	1	12	1	2	2	3	1	–	–	1		
										2	12	–	–	1	1	3	–	1	1	3	–
										3	12	–	1	3	4	–	–	2	2		
20	18	53 04	03 45	13	7·88	35·22	5	5	0115	1	11	1	–	1	–	3	–	1	1		
										2	11	1	1	–	–	–	1	2	–	3	1
										3	11	1	–	1	–	–	–	1	–		
20	19	52 57	04 02	13	7·44	35·13	5	5	0340	1	11	1	1	1	–	1	–	1	–		
										2	11	1	1	1	–	2	2	–	–	4	1
										3	11	2	–	–	–	2	–	1	1		
20	20	52 48	03 48	13	7·29	35·11	5	6	0517	1	11	1	–	–	2	–	2	–	1		
										2	11	2	1	2	–	–	–	–	–	5	3
										3	11	2	2	1	1	–	2	1	–		
20	21	52 41	04 05	13	6·55	34·84	5	6	0719	1–3	11	2	–	–	–	–	–	–	–	1	–
20	22	52 33	03 49	13	7·12	35·09	5	6	0910	1	12	1	–	–	–	–	–	–	–		
										2	12	3	–	1	–	–	–	–	–	3	–
										3	12	–	–	1	–	–	–	–	–		
20	23	52 40	03 32	14	7·58	35·18	5	5	1056	1	13	1	–	–	1	–	1	5	1		
										2	13	2	3	2	–	–	–	–	1	5	1
										3	13	1	1	2	2	1	–	–	–		
20	24	52 47	03 17	14	8·13	35·31	5	5	1232	1	12	2	–	–	2	–	–	2	–		
										2	12	1	–	–	3	–	1	1	–	2	3
										3	12	–	–	1	–	1	3	–	1		
20	25	52 38	03 03	16	8·29	35·27	5	5	1350	1	14	1	1	2	2	2	4	4	2		
										2	14	2	1	–	3	1	2	1	1	6	6
										3	14	1	3	1	2	2	2	7	–		
20	26	52 32	03 19	16	7·83	35·20	5	5/6	1547	1	13½	1	–	3	1	2	1	–	–		
										2	13½	1	2	1	2	–	–	–	–	4	1
										3	13½	1	1	3	–	1	1	–	1		
20	27	52 24	03 35	14	7·36	35·10	4	4	1754	1	12	2	–	–	–	1	–	–	–		
										2	12	2	–	–	–	–	–	–	–	5	–
										3	12	2	–	–	1	1	–	–	–		
20	28	52 18	03 50	13	6·70	35·02	4	4	1925	1	11	1	–	–	1	–	–	–	–		
										2	11	–	–	2	2	–	–	–	–	4	–
										3	11	1	2	–	–	–	–	–	–		
20	29	52 08	03 38	12	6·73	34·92	5	4	2059	1	10	–	–	–	–	–	–	–	–		
										2	10	–	–	1	1	–	–	–	–	1	–
										3	10	–	1	–	–	–	–	1	–		
20	30	52 15	03 21	13	7·42	35·13	5/6	4	2233	1	11	2	4	2	4	2	1	–	1		
										2	11	2	2	1	3	–	1	2	–	10	1
										3	11	2	1	2	1	–	–	–	1		
21	31	52 22	03 06	18	7·93	35·28	5	4	0012	1	15	1	3	4	4	2	1	–	1		
										2	15	–	2	1	5	2	–	–	1	8	4
										3	15	2	1	4	4	6	4	–	–		
21	32	52 29	02 50	22	8·46	35·27	4	4	0145	1	19	5	1	2	4	1	3	2	2		
										2	19	5	3	2	3	1	1	–	–	16	10
										3	19	3	2	4	2	3	7	–	–		
21	33	52 21	02 37	24	8·54	35·21	4	4	0311	1	21	9	4	2	6	1	2	–	–		
										2	21	11	3	4	3	3	–	–	–	27	2
										3	21	4	1	1	2	2	–	–	–		
21	34	52 14	02 52	19	8·34	35·27	4	4	0517	1	17	3	3	1	–	5	2	5	2		
										2	17	1	3	8	2	7	1	1	–	12	7
										3	17	2	2	2	2	2	5	–	–		
21	35	52 07	03 10	16	7·54	35·18	4	4	0727	1	12	2	–	–	3	–	4	–	1		
										2	12	1	–	–	–	3	–	–	–	7	4
										3	12	3	1	–	–	2	–	–	–		
21	36	52 00	03 26	14	7·27	35·06	4/5	4/5	0902	1	12	2	3	1	2	–	–	–	1		
										2	12	4	–	1	–	–	–	–	–	11	1
										3	12	3	1	2	1	2	1	–	–		
21	37	51 51	03 12	13	7·12	34·99	4	4	1024	1	11	–	–	2	–	–	–	–	–		
										2	11	3	3	–	1	–	1	–	–	9	3
										3	11	3	1	2	2	–	2	–	–		
21	38	51 58	02 56	17	7·85	35·15	4	4	1203	1	15	–	–	–	–	1	1	–	–		
										2	15	–	1	2	1	–	–	–	–	3	4
										3	15	–	2	1	1	2	4	–	–		

'SIR LANCELOT'. *Cruise* 2. 1950. 18–22 *January* (*cont'd.*)

Day	Station	Position N ° ′	Position E ° ′	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
21	39	52 05	02 40	23	8·54	35·23	4	4	1355	1	19	1	2	4	4	11	1	–	6	19	12
										2	19	5	4	2	7	3	7	1	1		
										3	19	6	3	6	2	8	5	–	1		
21	40	52 12	02 24	24	8·13	35·14	4	3	1604	1	21	1	1	–	1	–	–	–	–	3	–
										2	21	–	–	3	–	–	–		–		
										3	21	1	–	–	–	–	–	–	–		
21	41	52 03	02 11	19	7·19	35·09	4	3	1805	1–3	16	–	–	–	–	–	–	–	–	–	–
21	42	51 57	02 27	17	8·90	35·28	4	3	1949	1	15	–	–	7	1	4	1	4	3	3	3
										2	15	–	1	4	3	3	–	2	1		
										3	15	1	1	1	3	4	2	–	3		
21	43	51 50	02 47	19	8·21	35·18	3	3	2132	1	15	2	4	1	4	3	2	–	–	29	8
										2	15	9	1	2	6	2	3	–	–		
										3	15	2	5	–	2	5	1	1	–		
21	44	51 41	02 29	17	8·35	35·19	3	3	2250	1	15	2	–	–	–	–	1	–	–	7	5
										2	15	2	–	–	1	1	2	–	–		
										3	15	1	1	1	–	1	1	–	–		
22	45	51 48	02 14	23	8·95	35·29	3	3	0040	1	20	6	2	3	2	7	4	–	1	25	9
										2	20	4	7	1	3	7	2	2	–		
										3	20	–	3	1	3	6	2	2	1		
22	46	51 39	02 00	22	9·20	35·29	3	3	0222	1	17½	2	2	2	4	4	2	–	–	8	4
										2	17½	–	1	1	3	2	1	–	1		
										3	17½	1	–	1	1	1	–	–	–		
22	48	51 29	01 53	23	8·62	35·19	3	3	0930	1, 3	20½	–	–	–	–	–	–	–	–	–	1
										2	20½	–	–	–	–	–	1	–	–		
22	49	51 22	02 00	19	8·97	35·22	4	4	1046	1	17	3	1	1	1	–	1	1	–	7	2
										2	16½	–	–	–	–	1	–	–	–		
										3	16½	3	1	–	1	–	1	–	–		
22	50	51 21	02 20	15	7·29	34·93	4	4	1252	1	13	–	–	–	–	–	–	–	–	1	–
										2	13	–	1	–	–	–	–	–	–		
										3	13	–	–	–	–	1	–	–	–		
22	51	51 33	02 15	21	8·73	35·28	4	4	1431	1	19	–	–	1	–	1	2	2	–	2	2
										2	19	1	–	1	1	1	–	1	–		
										3	19	1	–	1	1	1	–	–	1		
22	52	51 38	02 39	18	8·06	35·13	4	4	1630	1	15	–	–	–	–	–	2	–	–	3	2
										2	15	1	2	2	–	–	–	–	–		
										3	15	–	–	–	–	–	–	–	–		
22	53	51 43	02 58	15	6·94	34·80	4	4	1807	1	13	1	3	–	2	–	–	2	–	6	–
										2	13	–	–	–	1	1	–	–	1		
										3	13	2	1	–	1	1	–	–	–		

'SIR LANCELOT'. *Cruise* 3. 1950. 2–9 *February*

Day	Station	Position N ° ′	Position E ° ′	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
2	2	52 19	02 07	23	5·7	34·92	4	4	1112	1–3	21	–	–	–	–	–	–	–	–	–	–
2	3	52 12	02 24	23	7·7	35·23	4	4	1303	1	20½	–	1	–	1	1	–	–	–	4	–
										2	20½	2	2	2	2	–	–	–	–		
										3	20½	–	–	–	1	1	–	–	–		
2	4	52 03	02 11	21	7·0	35·18	5	5	1535	1–3	17	–	–	–	–	–	–	–	–	–	–
2	5	51 57	02 27	22	7·4	35·21	5/6	5	1730	1	20	1	1	–	–	–	2	–	–	11	2
										2	19	7	1	–	1	1	1	1	–		
										3	19	4	1	1	1	–	–	1	–		
2	6	51 48	02 14	23	7·6	35·33	6/7	6	1933	1	21	5	–	–	1	–	5	–	–	8	8
										2	21	2	1	–	–	–	2	3	2		
										3	21	3	3	1	2	1	7	2	–		
4	9	51 29	01 53	25	8·5	35·26	4	4	0952	1	23	–	1	–	–	1	1	–	–	4	2
										2	23	1	1	–	–	3	2	–	–		
										3	23	1	1	2	–	–	–	1	–		
4	10	51 22	02 00	21	8·4	35·27	3	3/4	1125	1	19½	–	–	–	1	–	2	–	–	2	2
										2	19½	–	–	–	–	2	–	–	–		
										3	19½	2	–	–	–	–	–	–	–		
4	12	51 22	02 28	17	7·1	35·18	3	3	1315	1, 3	16	–	–	–	–	–	–	–	–	–	1
										2	16	–	–	–	–	1	1	–	–		
4	13	51 32½	02 15	24	8·3	35·32	3	3	1507	1	20	1	–	1	–	–	–	1	–	6	1
										2	20	1	–	–	–	–	1	–	–		
										3	20	3	–	–	–	–	–	–	–		
6	18	51 39	02 00	24	8·5	35·21	5	4/5	1152	1	23½	1	2	–	5	1	–	–	–	3	1
										2	23½	–	2	1	4	1	–	1	–		
										3	23½	–	–	1	–	1	1	–	1		
6	19	51 41	02 29	19	7·4	35·17	4	4/5	1432	1	18	1	2	–	–	–	–	–	–	9	–
										2	18	4	2	–	–	–	–	–	–		
										3	18	2	–	–	–	–	–	–	–		
6	20	51 37	02 43	19	7·0	35·19	4	4	1547	1, 2	16	–	–	–	–	–	–	–	–	1	–
										3	16	–	1	–	–	–	–	–	–		

'SIR LANCELOT'. *Cruise* 3. 1950. 2–9 *February* (*cont'd.*)

Day	Station	Position °N,	Position °E,	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
6	21	51 50	02 42	19	7·3	35·16	6/7	6	1737	1	19	–	1	–	–	–	1	–	–	4	1
										2	19	3	1	–	–	–	–	–	–		
										3	19	2	–	–	–	–	–	–	1		
6	22	51 43	02 58	21	6·7	35·04	7	7	1910	1–3	16	3	–	–	–	–	–	1	3	2	–
6	23	51 51	03 12	15	–	34·99	7	7	2119	1	13	10	9	–	–	–	–	–	–		
										2	13	8	4	1	–	–	–	–	–	21	–
										3	13	7	3	2	–	–	–	–	–		
6	24	51 58	02 54	19	7·0	35·30	5/6	6/7	2336	1	17	2	5	1	–	–	–	–	–		
										2	17	6	4	–	–	–	–	–	–	14	–
										3	17	3	3	2	–	–	–	–	–		
7	25	52 05	02 39	23	7·4	35·26	5	6	0153	1	21	7	6	4	6	5	3	–	1		
										2	21	10	14	8	4	1	1	–	–	33	4
										3	21	9	6	9	6	4	3	–	–		
7	26	52 21	02 37	23	7·4	35·26	5	5	0422	1	20	3	1	6	4	2	3	–	–		
										2	20	5	1	7	6	1	1	–	–	12	3
										3	20	3	3	–	2	4	–	–	1		
7	27	52 14	02 52	21	7·4	35·27	5	5	0628	1	17½	1	3	6	2	–	–	–	–		
										2	17½	5	1	1	–	2	–	–	–	8	–
										3	17½	1	–	–	1	–	–	–	–		
7	28	52 07	03 10	18	6·6	35·14	5	5	0811	1	16	3	1	1	1	–	–	–			
										2	16	–	–	2	–	2	–	–	–	5	–
										3	16	2	1	1	2	–	–	–	–		
7	29	52 00	03 26	15	5·1	34·43	5	5	1002	1	13	1	–	–	–	–	–	–	–		
										2	13	–	2	–	–	–	–	–	–	3	–
										3	13	–	1	–	–	–	–	–	–		
7	30	52 08	03 38	12	5·5	34·76	4	4	1135	1	10	–	–	4	1	–	–	–	–		
										2	10	2	–	3	–	–	–	–	–	1	–
										3	10	–	–	1	–	–	–	–	–		
7	31	52 15	03 22	16	6·4	35·26	5	5	1326	1	13	–	–	3	1	–	–	1	–		
										2, 3	13	3	–	2	3	2	–	–	–	2	–
7	32	52 22	03 05	18	7·2	35·31	5	5	1527	1	14	1	–	–	–	–	–	–	–		
										2, 3	14	–	–	2	–	–	–	–	–	1	–
7	33	52 29	02 50	22	7·5	35·26	5	5	1717	1	20	7	7	3	7	2	2	1	–		
										2	20	2	4	8	11	4	4	–	–	21	6
										3	20	5	5	7	8	6	2	–	1		
7	34	52 36	02 34	25	6·5	35·03	6	6	1920	1–3	22	2	2	–	–	–	–	–	–	2	–
7	35	52 44½	02 48	19	7·2	35·15	6	6	2055	1	16½	4	1	4	1	3	–	–	–		
										2, 3	16½	5	4	1	3	4	–	–	1	9	–
7	36	52 38	03 03	16	7·3	35·30	6	6	2235	1	14	2	–	1	3	2	1	–	–		
										2, 3	14	1	–	2	4	5	4	4	1	2	3
8	37	52 31	03 19	14	7·2	35·23	5	6/5	0018	1	12½	–	–	–	2	1	–	–	–		
										2, 3	12½	–	–	–	5	3	–	1	–	–	–
8	38	52 40	03 32	14	6·7	35·25	5	5	0220	1	13	1	2	.	3	7	4	1	1		
										2	13	–	–	1	3	1	3	–	1	3	6
										3	13	–	1	1	3	1	2	3	–		
8	39	52 46	03 16	17	7·2	35·21	5	5	0404	1	15	1	–	–	2	4	2	1	2		
										2	15	–	–	1	3	3	1	1	–	1	4
										3	15	1	–	3	6	4	3	3	2		
8	40	52 53	03 01	17	7·4	35·24	5	5	0532	1	15	–	–	2	1	10	2	13	3		
										2	15	3	1	2	5	9	10	3	3	3	15
										3	15	–	–	3	4	7	9	3	–		
8	41	53 01	02 44	20	6·6	34·97	4	5/4	0721	1	18	2	–	–	–	–	–	–	–		
										2, 3	18	5	–	–	–	–	–	2	–	6	–
8	42	53 09	02 57	18	6·6	34·80	4	4	0849	1	17	3	1	1	–	–	–	–	–		
										2	17	2	1	1	–	–	–	–	–	7	–
										3	17	1	–	–	1	–	–	–	–		
8	43	53 18	03 11	14	6·2	34·69	4	4	1026	1–3	13½	12	5	6	1	–	1	–	–	13	1
8	44	53 27	03 25	15	5·9	34·51	5	5	1202	1	14	1	2	3	–	–	–	–	–		
										2	14	2	2	1	–	–	–	–	–	5	–
										3	14	–	–	–	–	–	–	–	–		
8	45	53 20	03 42	15	6·2	34·73	5	5	1316	1–3	13	1	5	10	5	3	1	–	–	4	1
8	46	53 11	03 28	15	6·6	34·95	5	5	1517	1–3	13	3	5	6	5	3	3	–	–	6	2
8	47	53 03½	03 45	15	7·1	35·26	5	5	1700	1–3	13	3	2	1	5	8	5	17	8	4	4
8	48	52 56	04 02	13	6·4	35·26	5	5	1850	1–3	12	2	–	–	4	10	16	13	3	1	11
8	49	52 48½	03 48	13	6·4	35·25	5/6	5	2058	1	12½	1	–	1	3	7	3	–	–		
										2	12½	–	–	–	2	10	4	1	1	1	5
										3	12½	1	–	–	3	11	–	4	.		
8	50	52 42	04 05	13	5·7	35·13	6	6	2237	1	11	–	–	–	1	1	1	–	–		
										2	11	–	1	–	2	3	1	–	–	1	1
										3	11	–	–	2	.	2	.	.	–		
9	51	52 32½	03 49	15	6·0	35·13	6	6	0033	1	13	–	–	1	3	2	3	–	–		
										2	13	–	–	–	1	2	1	2	–	–	4
										3	13		–	–	4	2	3	1	.		
9	52	52 24	03 36	15	6·1	35·13	6	6	0220	1	13	1	–	1	5	–	1	–	–		
										2, 3	13	–	1	1	11	2	3	–	–	1	3

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Day	Station	Position N	Position E	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
18	7	54 10	02 14	19	6·4	34·64	4	4	1108	1–3	17	1	1	–	–	–	–	–	–	2	–
18	8	54 03	02 31	34	6·0	34·61	4	4	1254	1	32	–	–	–	1	–	–	–	–		
										2	32	–	–	–	–	–	–	–	–	-	
										3	32	–		–	–		–	1	–		
18	9	53 56	02 48	19	5·9	34·60	4	4	1458	1, 3	17	–	–	–	–	–	–	–	–		
										2	17	–	–	–	–	1	–	1	–	-	
18	10	53 49	03 04	24	5·7	34·59	4	4	1641	1	22	1	1	–	–	–	3	–	–		
										2	22	1		–	–	–	–	–	–	4	2
										3	22	2	–	–	–	–	–	–	–		
18	11	53 42	03 20	22	5·4	34·52	3	4, 3	1828	1	20	2	1	2	1	–	–	–	–		
										2	20	3	4	–	–	–	–	–	–	19	–
										3	20	3	4	2	–	–	–	–	–		
18	12	53 36	03 37	20	5·3	34·41	3	4 3	2003	1	19½	–	–	5	1	1	–	–	–		
										2	19½	1	1	2	1	–	–	–	–	5	–
										3	19½	2	1	2	–	–	–	–	–		
18	13	53 28	03 54	14	6·1	34·74	3	3	2240	1, 3	14	–	–	–	–	–	–	–	–	–	–
										2	14	–	–	3	1	–	–	–	–		
18	14	53 12½	03 58	15	7·2	35·30	3	3	2330	1	14	–	–	1	2	1	4	4	–		
										2	14	1	1	1	–	1	5	–	–	2	14
										3	14	–	–	–	–	3	4	–	–		
19	15	53 20	03 41½	15	6·1	34·23	3	3	0114	1	14	–	–	1		–	–	–	–		
										2	14	–	–	–		–	–	–	–	1	–
										3	14	–	1	–	–		–	–	–		
19	16	53 27	03 25	15	5·3	34·85	3	3	0248	1	14	1	1	–	–	–	–	–	–		
										2, 3	14	–	1	–			–	–	–	3	–
19	17	53 34	03 08½	17	5·3	34·50	2	2	0420	1–3	16	3	3	2	–	–	–	–	–		6
19	18	53 41	02 52	19	5·5	34·56	2	2	0558	1	18	–	–	–	–	–	1	1	–		
										2, 3	18	–	–	–	–	–	–	–	–	–	1
19	19	53 25	02 55	17	5·4	34·34	2	2	0747	1	15	1	1	–	–	–	–	–	–		
										2	15	1	–	–	–	–	–	–	–	5	–
										3	15	–	1	–	–	–	–	–	–		
19	20	53 18	03 12	17	6·0	34·85	2	2	0925	1	15	2	1	–	–	–	–	–	–		
										2	15	–	2	–	–	–	–	–	–	9	–
										3	15	2	1	–	–	–	–	–	–		
19	21	53 11	03 28	17	6·6	35·17	2	2	1055	1	14	1	–	1	–	1	2	–			
										2	14	1	1	–	1	–	–	–	–	6	2
										3	14	2	–	1	1	–	–	–	–		
19	22	53 04	03 45	14	7·3	35·29	2	2	1231	1	14	1	1	1	–	1	4	3	1		
										2	14		3	2	3	2	6	–	2	6	12
										3	14	1	–	–	–	1	2	2	–		
19	23	53 06	04 14	15	6·8	35·47	2	2	1458	1, 3	14	–	–	–	–	–	–	–		–	1
										2	14	–	–	–	–	–	1	–	–		
19	24	52 56½	04 02	14	6·7	35·29	3	2	1633	1	12	–	–	–	1	–	1	1	–		
										2	12	–	–	1	–	–	–	–	–	–	4
										3	12	–	–	1	1	–	2	–	–		
19	25	52 48½	03 48	14	6·6	35·25	3	3	1824	1	12	–	–	–	–	–	1	1	–		
										2	12	–	1	1	–	–	1	1	–	2	7
										3	12	–	1	–	3	1	4	1	–		
19	26	52 55	03 30	14	7·2	35·34	2/3	2	1955	1	13	–	–	–	–	–	3	5	–		
										2	13	1	–	–	1	–	1	–	–	1	8
										3	13	–	–	–	–	–	3	–	–		
19	27	53 02	03 14	16	6·8	35·16	3	3	2151	1	13	–	2	1	1	1	1	–	–		
										2	13	–	1	1	–	–	–	–	–	6	2
										3	13	2	–	–	2		1	–	–		
19	28	53 09	02 57	17	6·6	35·11	3	3	2350	1	14	1	1	2	1	–	–	–	–		
										2	14	3	7	1	1	–	–	–	–	19	–
										3	14	2	2	3	1	–	–	–	–		
20	29	53 16	02 41	17	5·4	34·38	4	4	0144	1	14	3	–	–	–	–	–	–	–		
										2	14	4	1	–	–	–	–	–	–	7	–
										3	14	–	–	–	–	–	–	–	–		
20	30	53 07½	02 27	19	5·6	34·44	4	4	0330	1, 2	15	–	–	–	–	–	–	–	–		
										3	15	1	1	–	–	–	–	–	–	2	–
20	31	53 01	02 44	19	7·4	35·34	4 5	4	0538	1	15	–	–	1	1	–	–	–	–		
										2	15	–	–	–	–	–	–	–	–	2	–
										3	15	2	–	1	–	–	–	–	–		
20	32	52 53½	03 01	21	7·3	35·35	5	4 5	0732	1	18	–	–	1	2	5	5	–	–		
										2	18	1	–	–	2	3	3	1	–	1	6
										3	18	–	1	–	4	3	–	1	1		
20	33	52 46½	03 16½	14	7·0	35·34	5	4 5	0910	1	13	–	–	–	1	–	3	–	–		
										2	13	–	–	–	–	2	6	4	–	–	8
										3	13	–	–	–	1	2	3	1	1		
20	34	52 40	03 32	15	6·9	35·34	5	5	1051	1	12	–	–	–	–	2	1	–	–		
										2	12	1	–	–	–	–	1	–	–	2	2
										3	12	1	–	–	–	1	–	–	–		
20	35	52 33	03 49	15	6·3	35·05	6	5 6	1222	1	12	–	1	–	–	–	4	1	–		
										2	12	–	–	–	1	–	1	–	–	1	3
										3	12	–	–	–	1	2	–	–	–		
20	36	52 24	03 35	15	6·5	35·14	6	5 6	1449	1	12	–	–	–	2	10	8	–	–		
										2	12	–	–	–	1	9	3	–	–	–	10
										3	12	–	–	–	3	3	3	–	1		
20	37	52 31½	03 19	16	6·9	35·17	6	6	1712	1	13	–	–	1	–	1	–	–	1		
										2	13	–	–	–	–	–	2	–	–	–	4
										3	13	–	–	–	1	2	4	–	1		
20	38	52 37½	03 03	17	7·3	35·34	6	6	1936	1	16	–	–	–	–	4	2	–	2		
										2	16	–	–	–	2	9	7	1	–	–	12
										3	16	–	–	1	2	2	12	1	–		
20	39	52 44½	02 47	24	7·8	35·37	6	6	2305	1	21	–	–	–	–	–	–	2	1		
										2	21	1	1	–	–	1	–	1	1	3	–
										3	21	2	1	–	–	–	–	1	1		

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Day	Station	Position °N	Position °E	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
21	40	52 36	02 34½	24	7·5	35·30	6	6	0033	1	21	2	1	–	–	–	–	–	–		
										2	21	2	–	–	–	–	–	1	–	4	–
										3	21	1	–	–	–	–	–	–	–		
21	41	52 29	02 50½	24	7·7	35·37	6	6	0212	1	21	1	–	1	5	14	5	–	5		
										2	21	–	–	7	11	19	3	–	3	1	6
										3	21	–	1	4	4	9	1	–	1		
21	42	52 22	03 05½	18	7·1	35·29	7	6+	0347	1	16	1	1	1	3	5	–	–	–		
										2	16	1	–	1	1	3	7	–	–	3	5
										3	16	2	–	1	2	4	2	–	–		
21	43	52 15	03 21½	15	7·4	35·32	7	6+	0527	1–3	13	–	–	–	–	–	–	–	–	–	–
21	44	52 07	03 09	18	7·6	35·29	6	6	0713	1	15	–	–	–	2	3	1	–	–	–	1
										2–3	15	–	–	–	–	–	–	–	–		
21	45	52 14	02 52½	20	7·9	35·33	5	5	0938	1	18	1	2	–	1	1	–	1	–		
										2	18	–	–	1	2	1	1	–	–	2	1
										3	18	–	–	1	–	1	–	–	–		
21	46	52 21	02 37	23	8·3	35·34	5	5	1145	1	22	10	2	2	6	6	5	5	6		
										2	22	3	1	2	–	6	3	–	–	14	12
										3	22	3	2	1	4	2	10	1	2		
21	47	52 12	02 23	24	8·1	35·32	5	5	1325	1	22	6	3	2	4	1	–	1	–		
										2	22	5	3	4	2	–	–	–	–	25	–
										3	22	10	9	1	4	2	–	–	–		
21	48	52 05	02 40	25	8·2	35·32	5	5	1510	1	23	2	–	4	5	2	4	2	–		
										2	23	3	1	2	7	2	6	–	–	5	8
										3	23	–	1	–	8	13	2	–	–		
21	49	51 57	02 27	24	8·5	35·33	5	5	1702	1	20	3	–	2	2	2	–	1	–		
										2	20	1	–	–	1	2	2	–	–	5	2
										3	20	1	2	5	1	3	–	–	–		
21	50	52 03	02 10½	18	8·3	35·30	4	5/4	1840	1–3	16	–	–	–	–	–	–	–	–	–	–
21	51	51 48	02 13½	16	8·6	35·27	4	4	2045	1	14	2	–	2	–	1	–	–	–		
										2	14	–	1	–	2	–	–	–	–	3	–
										3	14	–	–	1	–	–	–	–	–		
21	52	51 39½	02 00	23	8·5	35·28	3	3	2206	1–3	21	6	1	1	1	–	–	–	–	8	–
22	56	51 32½	02 15	16	8·6	35·26	2	2	0927	1	12	–	–	1	–	–	–	–	–		
										2–3	12	–	–	–	–	–	–	–	–	–	–
22	57	51 41½	02 29	18	8·3	35·28	3	3	1140	1	16	–	–	–	–	1	–	1	–		
										2	16	–	–	–	–	–	–	–	–	–	–
										3	16	–	–	1	–	–	–	–	–		
22	58	51 38	02 43	19	8·1	35·27	3	3	1300	1–3	17	–	–	–	–	–	–	–	–	–	–
22	59	51 49½	02 43	19	8·2	35·28	3	3	1500	1	17	–	1	1	–	–	–	–	–		
										2	17	1	1	1	–	–	–	–	–	3	–
										3	17	–	–	–	–	–	–	–	–		
22	60	51 58	02 56	20	8·0	35·34	3	3	1620	1	18	–	–	3	1	–	–	–	–		
										2	18	–	–	1	–	–	–	–	–	–	–
										3	18	–	–	2	3	–	–	–	–		
22	61	51 43	02 58	15	7·8	35·28	2	2	1905	1–3	13	–	–	–	–	–	–	–	–	–	–
23	64	51 51½	03 12	12	7·3	35·25	2	2	0015	1, 2	10	–	–	–	–	–	–	–	–		
										3	10	1	–	1	–	–	–	–	–	1	–
23	65	52 00	03 26	12	5·9	34·63	2	2	0206	1	10	–	1	2	1	–	–	–	–		
										2	10	2	–	1	–	–	–	–	–	7	–
										3	10	3	–	1	–	–	–	–	–		
23	66	52 08	03 37½	14	5·6	34·67	3	2	0347	1	12	1	–	–	4	2	1	–	–		
										2	12	–	–	–	4	–	–	–	–	1	1
										3	12	–	–	–	3	–	–	–	–		
23	67	52 17½	03 49	13	5·6	34·70	3	2/3	0538	1	11	–	–	–	–	3	1	–	–		
										2	11	–	–	–	–	3	1	–	–	–	2
										3	11	–	–	–	–	3	–	–	–		
24	75	52 27½	02 21½	26					0250	1–3	24	–	–	–	–	–	–	–	–	–	–

'SIR LANCELOT'. *Cruise* 5. 1950. 9–12 *March*

Day	Station	Position °N	Position °E	Depth of water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
9	11	52 26½	04 01	12	5·86	34·13	2	2	1235	1	9	–	–	–	–	–	1	1	1	–	1
										2, 3	9	–	–	–	–	–	–	–	–		
9	12	52 17½	03 49	10	5·76	33·91	2	2	1358	1	7	–	–	–	–	–	–	2	–		
										2	7	–	–	–	–	–	–	1	1	–	–
										3	7	–	–	–	–	–	–	–	–		
9	13	52 08	03 37	13	6·30	34·69	2	2	1515	1	10	2	–	1	1	–	3	4	–		
										2	10	1	–	1	–	1	4	–	1	4	12
										3	10	–	–	1	1	1	2	–	–		
9	14	52 00	03 26	15	6·55	34·88	3	3	1709	1, 3	13	–	–	–	–	–	–	–	–	–	–
										2	13	–	–	1	–	–	–	1	–		
9	15	52 07	03 10	14	7·51	35·28	3	3	1851	1, 3	12	–	–	–	–	–	–	–	–	–	–
										2	12	–	–	–	–	–	–	–	1		
9	16	51 58	02 56	18	7·83	35·28	4	3	2050	1–3	16	–	–	–	–	–	–	–	–	–	–
9	17	52 04½	02 40	22	8·03	35·28	5	4	2230	1	20½	–	–	–	–	–	–	–	1		
										2	20½	–	–	–	–	–	–	1	1	·	
										3	20½	–	–	–	–	–	–	–	–		

'SIR LANCELOT'. *Cruise* 5. 1950. 9–12 *March* (*cont'd.*)

Day	Station	Position °N ′	Position °E ′	Depth of Water (fm)	Temperature °C	Salinity ‰	Wind	Sea	Time	Net	Depth of Water filtered (fm)	Actual Catch per Haul: Egg Stages IA	IB	II	III	IV	V	Larvae	Post Larvae	Mean per Station: I per m²	V per m²
10	18	52 11½	02 24	24	8·03	35·32	5/6	4/5	0041	1	22	–	–	–	–	1	–	4	–		
										2	22	1	–	–	1	–	1	3	2	1	1
										3	22	1	–	–	2	–	–	1	2		
10	19	52 20½	02 37	24	7·74	35·30	5/6	4/5	0248	1	20	7	2	5	4	1	–	–	–		
										2	20	8	2	4	1	2	–	–	–	22	1
										3	20	9	1	6	7	2	1	–	–		
10	20	52 29	02 50	22	7·94	35·35	6	5	0426	1	20	–	–	–	–	5	4	6	3		
										2	20	–	–	–	2	9	6	19	5	–	13
										3	20	–	–	–	2	4	10	6	2		
10	21	52 14	02 52	21	7·88	35·32	6	5	0628	1	20	–	–	–	–	–	1	2	1		
										2	20	–	–	–	–	–	1	1	–	–	1
										3	20	–	–	1	–	–	–	1	–		
10	22	52 22	03 05	16	7·83	35·34	6	5	0743	1, 2	14	–	–	–	–	–	–	–	–	–	–
										3	14	–	–	·	–	1	·	·	–		
10	23	52 15	03 22	14	7·29	35·32	5/6	5	0924	1–3	11	–	–	–	–	–	·	–	–		–
10	24	52 24	03 36	14	6·65	35·15	5/6	5	1137	1	11½	–	–	–	–	–	–	–	1		
										2	11½	–	–	–	–	–	–	1	–	–	–
										3	11½	–	–	–	–	–	–	–	1		
10	25	52 31	03 18½	16	7·04	35·28	5/6	5	1405	1	15	–	–	–	–	–	–	–	1	–	–
										2, 3	15	–	–	–	–	–	–	–	–		
10	26	52 38	03 03	18	7·73	35·35	5	5	1555	1	16	–	–	–	–	–	–	11	7		
										2	16	–	–	–	–	1	1	2	–	–	1
										3	16	–	–	–	–	–	1	3	10		
10	27	52 46	03 16	15	7·34	35·35	4/5	4	1738	1	13	–	–	–	–	–	–	–	4		
										2	13	–	–	–	–	–	–	–	4	–	–
										3	13	–	–	–	–	–	–	1	–		
10	28	52 39½	03 32	14	6·90	–	4	4	1915	1	12	–	–	–	–	–	–	–	·		
										2	12	–	–	–	–	–	–	–	2	–	–
										3	12	–	–	–	–	–	–	1	–		
10	29	52 32½	03 49	14	6·21	35·10	4	4	2058	1	12	–	–	–	–	–	–	1	1	–	–
										2, 3	12	–	–	–	–	–	–	–	·		
10	30	52 41	04 04	13	6·25	34·87	4	4	2240	1	10	–	–	–	–	–	–	1	–		
										2	10	–	–	–	–	–	–	1	1	–	–
										3	10	–	–	–	–	–	–	1	1		
11	31	52 48	03 48	14	6·60	35·23	4	4	0018	1	11	–	–	–	–	–	–	–	2		
										2	11	–	–	–	–	–	–	–	–	–	–
										3	11	–	–	–	–	–	–	1	3		
11	32	52 55	03 31	16	7·05	35·35	4	4	0225	1	14	–	–	–	–	–	–	6	1		
										2	14	–	–	–	–	–	–	3	6	–	–
										3	14	–	–	–	–	–	–	3	1		
11	33	53 02	03 15	14	7·34	35·35	5	4	0413	1–3	13	1	–	–	–	3	1	1	–	1	1
11	34	53 11	03 28	14	7·04	35·35	5	4/5	0556	1–3	12	–	–	–	–	–	–	–	–	–	–
11	35	53 04	03 45	15	6·85	35·30	5/6	5	0818	1	14	–	–	–	–	–	–	–	1		
										2	14	2	2	–	1	–	–	3	2	3	1
										3	14	–	1	–	–	–	1	6	8		
11	36	52 56½	04 02	14	6·75	35·35	6	5/6	1024	1	12	–	–	–	–	–	–	–	1		
										2	12	–	–	–	–	–	–	1	–	1	–
										3	12	1	–	–	–	–	–	1	1		
11	37	53 06	04 14½	15	6·85	35·35	6	5/6	1222	1	13	1	–	–	1	–	–	2	1		
										2	13	–	–	–	1	1	1	–	–	1	1
										3	13	–	–	–	–	2	1	2	–		
11	38	53 14	04 27	17	6·70	35·28	6	6	1442	1	13	–	–	–	–	1	1	3	9		
										2	13	–	–	–	2	1	–	–	5	–	1
										3	13	–	–	–	2	2	1	4	2		
11	39	53 21	04 11	17	6·70	35·29	6/7	6	1713	1	13	–	–	–	1	–	–	3	2		
										2	13	2	–	–	1	4	1	1	1	1	2
										3	13	–	–	–	–	–	2	3	–		
11	40	53 12½	03 58	12	6·60	35·19	6/7	6	1956	1	10	1	–	–	1	–	–	–	1		
										2	10	1	–	–	1	–	1	3	–	5	1
										3	10	5	–	–	–	–	1	1	1		
11	41	53 20	03 42	14	6·85	35·42	6/7	6	2328	1–3	12	2	–	–	3	1	–	2	3	1	–
12	42	53 27	03 25	15	5·76	34·79	6/7	6	0415	1–3	13	2	1	4	3	5	8	–	1	2	5
12	43	53 18	03 11	16	6·05	34·82	6	6	1012	1	14	1	–	–	2	7	–	1	–		
										2	14	–	–	–	3	3	2	–	–	1	4
										3	14	1	–	1	4	2	5	–	–		
12	44	53 25	02 55	16	5·66	34·48	5/6	5/6	1307	1	14	–	1	2	–	–	1	–	–		
										2	14	–	–	–	–	2	2	–	–	1	2
										3	14	–	1	2	1	1	–	–	–		
12	45	53 16	02 41	15	5·66	34·55	5/6	5/6	1434	1	13	–	–	–	–	–	–	–	–		
										2	13	1	–	1	–	–	1	–	–	1	1
										3	13	–	–	–	–	2	–	–	–		
12	46	53 09	02 58	17	6·14	34·82	5	5	1551	1–3	14	–	3	–	4	1	5	1	–	2	4
12	47	53 00½	02 44	19	5·86	34·67	5	5	1717	1–3	17	–	–	–	–	–	–	–	–	–	–
12	48	52 53½	03 01	17	6·80	35·17	5	5	1846	1–3	14	4	1	1	4	3	1	–	–	4	1
12	49	52 44½	02 48	19	6·99	35·17	5	5	2005	1–3	17	3	–	3	–	2	–	–	–	2	–
12	50	52 36	02 34	23	6·70	35·03	5	5	2140	1–3	20	1	2	1	1	–	–	–	–	2	–
12	51	52 27½	02 22	25	5·51	34·47	5	4	2325	1–3	22	–	–	–	–	–	–	–	–	–	–

APPENDIX II

Table 1. *Age composition of plaice, Southern Bight,* 1947/48

A. Positions 6, 9 *and* 10

Date	*Hours fishing*	*Sex*	*Maturity*	*AGE GROUPS*																	*Total Aged*	*Not Aged*
				I	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*	*XI*	*XII*	*XIII*	*XIV*	*XV*	*XVI*	*XVII*		
17–19 December 1947	18	M	Imm.	4	4	6	1		1												16	
		F	Imm.																		0	
		M	Mat.	8	29	52	96	30	34	28	30	24	14	8	5	4	3				365	1
		F	Mat.				8	2	1	6	12	13	8	6	1	1	1	1			60	
31 December 1947	6	M	Imm.	3	1		1														5	
		F	Imm.																		0	
		M	Mat.	5	12	14	35	13	10	8	7	1	1	1							107	
		F	Mat.		1	1	5	1		4	7	7	3	3	2	1					35	
7–9 January 1948	6¾	M	Imm.			2	3														5	
		F	Imm.																		0	
		M	Mat.	2	21	26	18	18	9	9	8	6	2	3							122	
		F	Mat.				2		3		2	4	6	1	2	2					22	
14 January 1948	3	M	Imm.		11	4	5		1												21	
		F	Imm.				1														1	
		M	Mat.	1	12	11	25	4	8	7	5	9	3	2	2		1				90	
		F	Mat.			1	2		1	2	3	5	1	2	2	1					20	
20–23 January 1948	18	M	Imm.	1	28	14	14	2		1											60	
		F	Imm.		1				1												2	
		M	Mat.	7	154	160	180	62	51	37	23	15	8	7	3	1					708	3
		F	Mat.		2	7	9	2	3	7	7	11	5	3	8	2	2			1	69	
29 January 1948	3	M	Imm.																		0	
		F	Imm.		1																1	
		M	Mat.		16	22	11	3	5	2											59	
		F	Mat.			1		2		1	2	4		1	3						14	
10–12 February 1948	15	M	Imm.	1	28	5	7	1													42	
		F	Imm.	2	16	14	10		1												43	
		M	Mat.	3	161	277	187	41	20	10	3	10	3	3	3						721	2
		F	Mat.		2	8	16	13	4	4	4	2	2	3	2		1				61	
18–19 February 1948	9	M	Imm.	2	5	1															8	
		F	Imm.	1	2	2															5	
		M	Mat.		66	72	69	9	6	1		2									225	
		F	Mat.		8	13	11	4	1	1	1	2		1							42	

B. Positions 7, 8 *and* 11

20–23 January 1948	18	M	Imm.	5	48	17	9	1	1												81	1
		F	Imm.		3	4	5	2													14	2
		M	Mat.	21	298	189	144	63	46	32	18	11	4	3	4						833	3
		F	Mat.		5	7	16	5	8	10	17	7	5	4	1	1	1		1		88	
10–12 February 1948	12	M	Imm.	1	8	2	2														13	
		F	Imm.				1														1	
		M	Mat.		43	40	36	13	10	8	9	6	2	1	1						169	
		F	Mat.		1	1	10	4	2		1	2		1							22	

C. Tables A and B combined

All	108¾	M	Imm.	17	133	51	42	4	3	1											251	1
		F	Imm.	3	23	20	17	2	2												67	2
		M	Mat.	47	812	863	801	256	199	142	103	84	37	28	18	5	4				3,399	9
		F	Mat.		19	39	79	33	23	35	56	57	30	25	21	8	5	1	1	1	433	
	%	M	Mat.	1	24	25	24	8	6	4	3	2	1	1	1	0	0				100	
		F	Mat.		4	9	18	8	5	8	13	13	7	6	5	2	1	0	0	0	99	

Location of positions referred to in Tables A and B above.

Position 6: 52°1′N 2°26′E
,, 9: 52°12′N 2°35′E
,, 10: 52°12′N 2°54′E

Position 7: 52°1′N 2°45′E
,, 8: 52°1′N 3°5′E
,, 11: 52°12′N 3°14′E

Table 2. *Age composition of plaice, Southern Bight*, 1948/49

Positions of trawling on each survey: a. 52°17′N 3°02′E.
b. 52°17′N 3°19′E
c. 52°25′N 3°11′E

Date	Hours Fishing	Sex	Maturity	AGE GROUPS I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	Total Aged	Not Aged
19–20 December 1948	18	M	Imm.		28	62	7																97	1
		F	Imm.		34	73	20	10	2														139	
		M	Mat.	3	23	93	35	13	5	7	3	3	1	2	1								189	
		F	Mat.			3	2	1	1	3	1	3	3		1	1			1			1	21	1
9–10 January 1949	18	M	Imm.	2	24	69	12	2	2														111	15(1)
		F	Imm.	1	44	75	18	10	1														149	35(1)
		M	Mat.	11	58	313	92	45	17	20	20	10	7	7	4	3							607	87(1)
		F	Mat.			13	5	16	5	5	8	10	3	5	4	4	2	3					83	
26–27 January 1949	18	M	Imm.	6	33	39	7	2															87	
		F	Imm.	2	40	73	13	9	1	1													139	
		M	Mat.	10	61	242	51	21	15	14	10	6	5	1	1								437	562(3)
		F	Mat.	1	2	17	11	15	4	4	9	10	10	6	2	1	3	2					97	
11–12 February 1949	18	M	Imm.	1	23	24	2																50	
		F	Imm.	3	28	72	8	10															121	1
		M	Mat.	7	79	299	76	33	12	18	17	4	4										539	
		F	Mat.		1	31	16	16	13	1	2	4	1	2	6		2	1					96	
10–11 March 1949	18	M	Imm.	10	63	32	3	1															109	
		F	Imm.	13	129	146	18	1	1														308	151(1)
		M	Mat.	17	100	268	45	13	2	3	3	1	1										453	194(1)
		F	Mat.		3	68	30	12	2	2	2	7	2	3	1	1		1	1				135	
All	90	M	Imm.	19	171	226	31	5	2														454	16
		F	Imm.	19	275	439	77	40	5	1													856	187
		M	Mat.	48	321	1,215	299	125	51	62	43	24	18	10	6	3							2,225	843
		F	Mat.	1	6	132	64	60	25	15	22	34	19	16	14	7	7	7	2		8	1	432	1
	%	M	Mat.	2	14	55	13	6	2	3	2	1	1	0	0	0							99	
		F	Mat.	0	1	31	15	14	6	3	5	8	4	4	3	2	2	2	0			0	100	

(1) Fish from 1 3-hour haul not otolithed.
(3) Fish from 3 3-hour hauls not otolithed.

Table 3. *Age composition of plaice, Flamborough*, 1949

For trawling positions see Figs. 23–26.

Date	Hours Fishing	Sex	Maturity	AGE GROUPS I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	Total Aged	Not Aged
23–24 January 1949	18	M	Imm.		1	34	10	3													48	
		F	Imm.		8	60	73	35	3												179	
		M	Mat.		6	38	53	46	30	14	11	9	5	1	1						214	
		F	Mat.				3	2	2	2	7	4	6	3	3	1	2	1			36	
7–8 February 1949	18	M	Imm.		4	61	15	2													82	
		F	Imm.		31	99	47	12	3												192	
		M	Mat.		27	73	66	21	8	5	9	5	2	1							217	
		F	Mat.		1	6	9	8	6	3	4	6	11	5	2	3	2	2			68	
21–22 February 1949	18	M	Imm.			8															8	
		F	Imm.		8	52	49	22	3	1											135	
		M	Mat.		20	79	86	38	22	6	11	4	2	2							270*	
		F	Mat.			9	8	10	12	3	6	7	7	5	4	2	3	1		1	78	
15–16 March 1949	18	M	Imm.		10	35	6	2													53	
		F	Imm.	2	25	75	38	15	2	1											158	1
		M	Mat.		11	69	76	33	14	13	15	12	4	2	1						250	
		F	Mat.			5	9	4	6	1	2		2	1	1	2					33	
All	72	M	Imm.		15	138	31	7													191	
		F	Imm.	2	72	286	207	84	11	2											664	1
		M	Mat.		64	259	281	138	74	38	46	30	13	6	2						951	
		F	Mat.		1	20	29	24	26	9	19	17	26	14	10	8	7	4		1	215	
	%	M	Mat.		7	27	30	15	8	4	5	3	1	1	0						101	
		F	Mat.		0	9	13	11	12	4	9	8	12	7	5	4	3	2		0	99	

*It is possible that some 40 of these mature males should have been classified as immature males.

Table 4. *Age composition of plaice, Southern Bight,* 1950

A. Brown Ridge Area

Trawling Positions as on Appendix II, Table 2.

Date	*Hours fishing*	*Sex*	*Maturity*	*AGE GROUPS*															*Total Aged*	*Not Aged*
				I	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*	*XI*	*XII*	*XIII*	*XIV*	*XV*		
7–8 January 1950	9	M	Imm.																	47
		F	Imm.																	104
		M	Mat.	8	156	137	174	37	11	10	14	9	4	4	2	1		1	568	1
		F	Mat.		3	2	3	2	4	1	2		1	2			1		21	
23 January 1950	6	M	Imm.																	7
		F	Imm.																	20
		M	Mat.	10	102	157	142	32	13	13	7	5	1						482	1
		F	Mat.				2	4	3	1	2	3	5	1		1			22	1
9 February 1950	8	M	Imm.																	1
		F	Imm.																	25
		M	Mat.	11	119	127	61	4	1	1	1	1							326	2
		F	Mat.		1	3	12	3	1			1	1	1					23	
23 February 1950	6	M	Imm.																	3
		F	Imm.																	8
		M	Mat.	2	11	18	20	7	2	3	2	3							68	
		F	Mat.			3	1		1		1	1							7	
All	29	M	Imm.																	58
		F	Imm.																	157
		M	Mat.	31	388	439	397	80	27	27	24	18	5	4	2	1		1	1,444	4
		F	Mat.		4	8	18	9	9	2	5	5	7	4		1	1		73	1

B. North Falls Area

Trawling Position: 51°35′N 2°01′E.

Date	Hours Fishing	Sex	Maturity	AGE GROUPS I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	Total Aged	Not Aged
8–9 January 1950	10	M	Imm.																	?
		F	Imm.																	?
		M	Mat.	6	122	117	58	26	13	9	6	4	4		1	1			367	3
		F	Mat.	1	9	11	7	4	5				5	3	1	3	2	1	52	
22 January 1950	4	M	Imm.																	2
		F	Imm.																	7
		M	Mat.	8	176	132	43	20	6	2	3	5	1						396	1
		F	Mat.		3	5	3		2	1	1	4	1						20	
4–5 February 1950	8	M	Imm.																	3
		F	Imm.																	21
		M	Mat.	9	79	88	30	23	4	4	4	1							242	190*
		F	Mat.		4	6	9	10	1	1	3	6	1	1					42	
22 February 1950	6	M	Imm.																	2
		F	Imm.																	4
		M	Mat.	9	50	59	39	9	1	1									168	
		F	Mat.		2	5	6	1				1				1			16	
All	18	M	Imm.																	7
	18	F	Imm.																	32
	28	M	Mat.	32	427	396	170	78	24	16	13	10	5		1	1			1,173	194
	28	F	Mat.	1	18	27	25	15	8	2	4	11	7	4	1	4	2	1	130	

*The mature males from one 2-hour haul.

C. Tables A and B combined

Tables A and B All	47	M	Imm.																	65
	47	F	Imm.																	189
	57	M	Mat.	63	815	835	567	158	51	43	37	28	10	4	3	2		1	2,617	198
	57	F	Mat.	1	22	35	43	24	17	4	9	16	14	8	1	5	3	1	203	1
	%	M	Mat.	2	31	32	22	6	2	2	1	1	0	0	0	0		0	99	
		F	Mat.	0	11	17	21	12	8	2	4	8	7	4	0	2	1	0	97	

APPENDIX

Distribution of group I and group V plaice eggs below $1m^2$ of sea surface on all surveys between 1945 and 1950 inclusive. A space left blank indicates that no survey was made at that time.

All stations worked are marked with a dot and contours have been drawn at values of 1, 5, 15, 25, 35, 45 eggs below $1m^2$.

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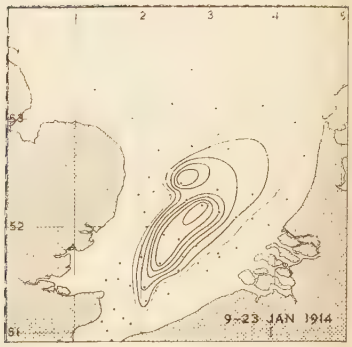

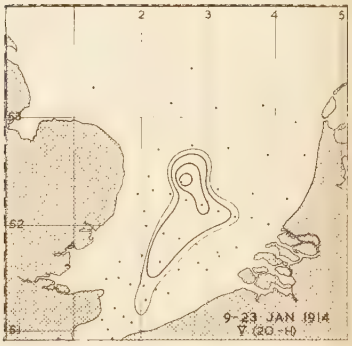

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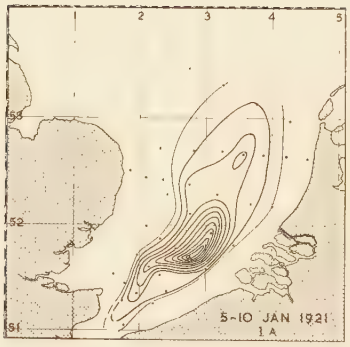

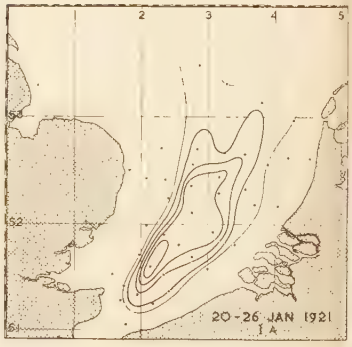

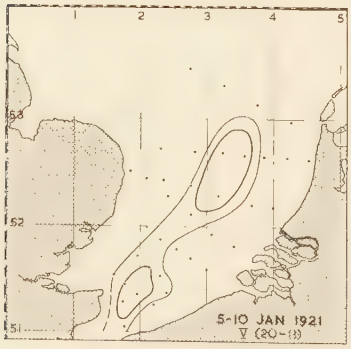

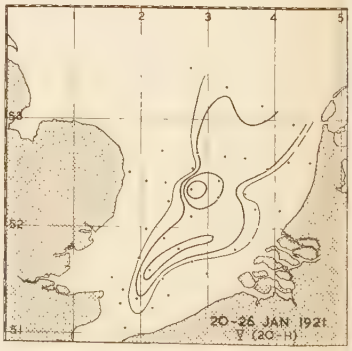

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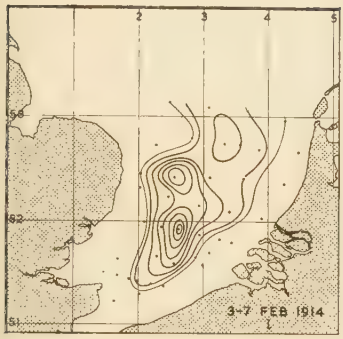

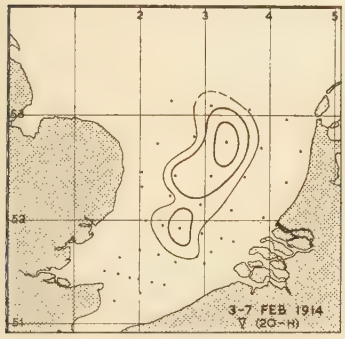

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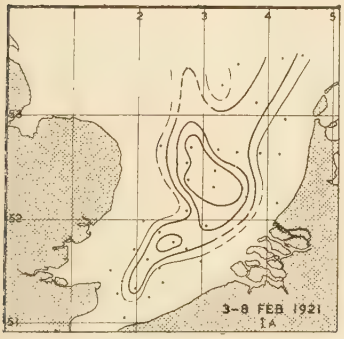

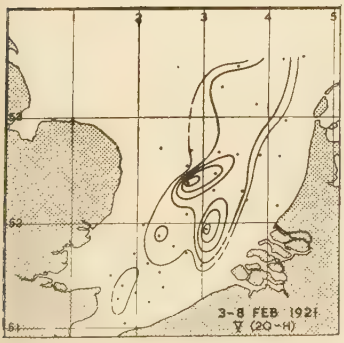

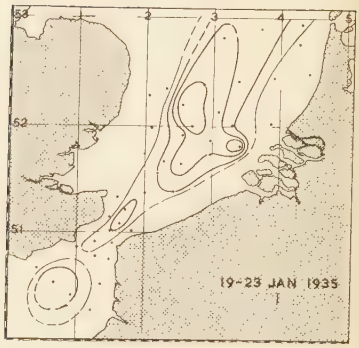
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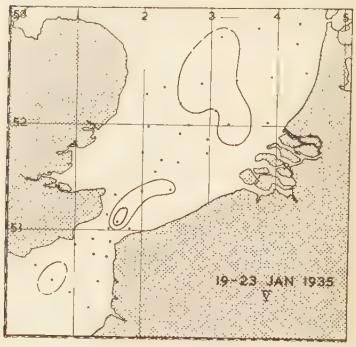
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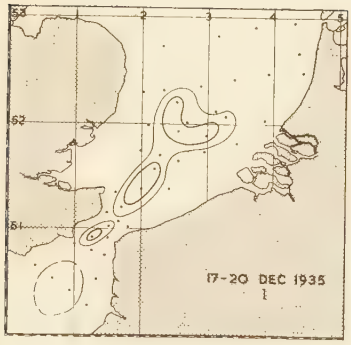
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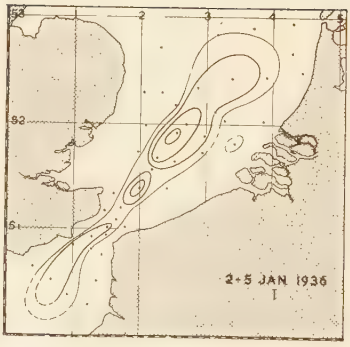
2-5 JAN 1936
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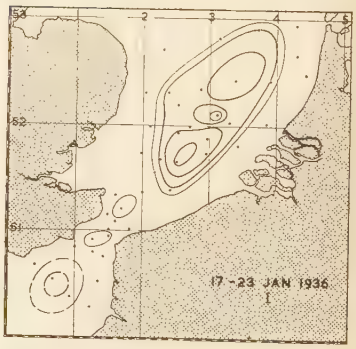
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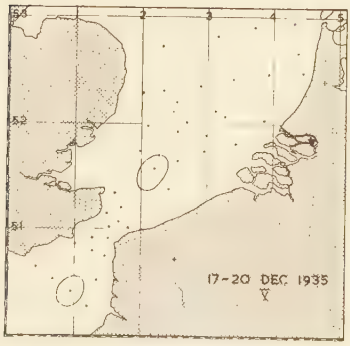
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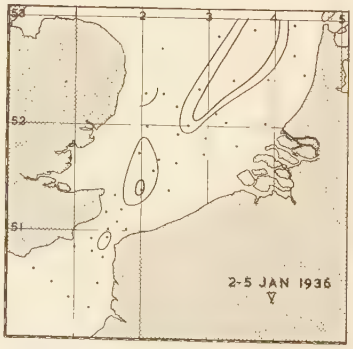
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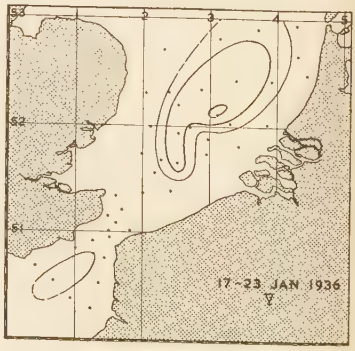
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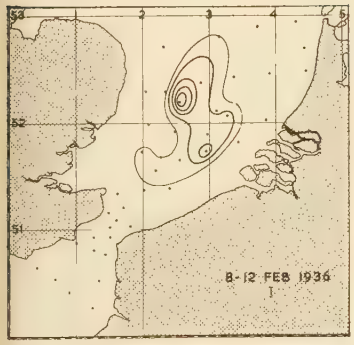
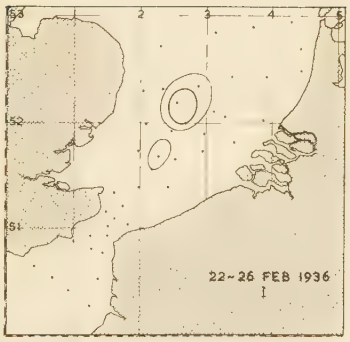
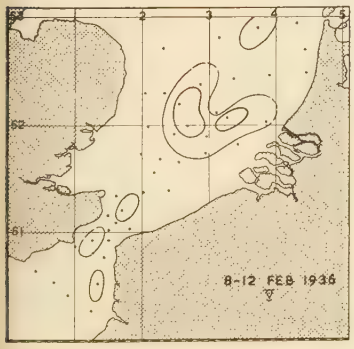
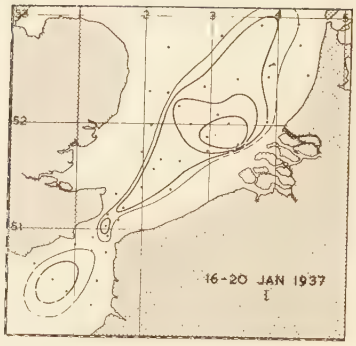
1934-1935

1935-1936





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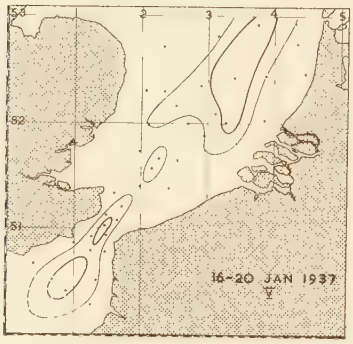
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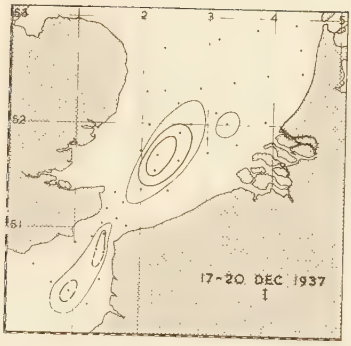
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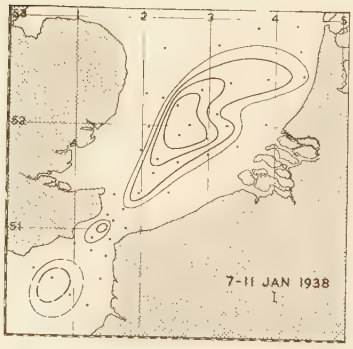
7-11 JAN 1938
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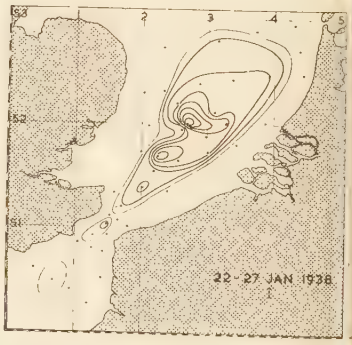
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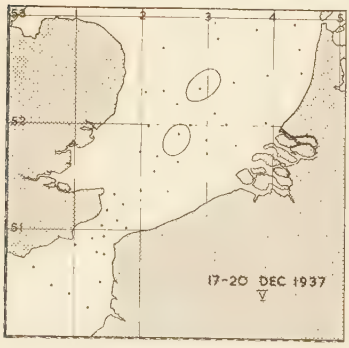
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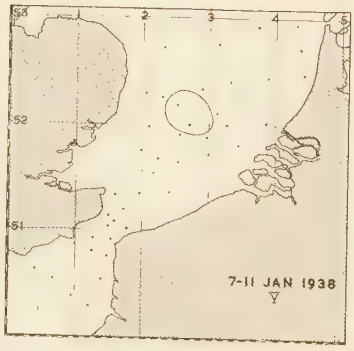
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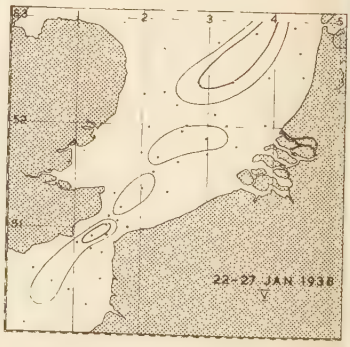
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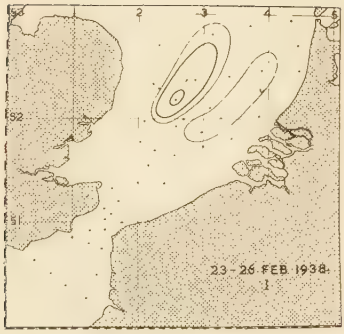
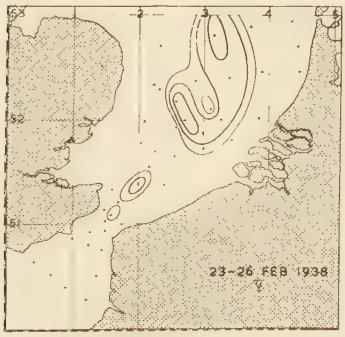
V

1936-1937

1937-1938





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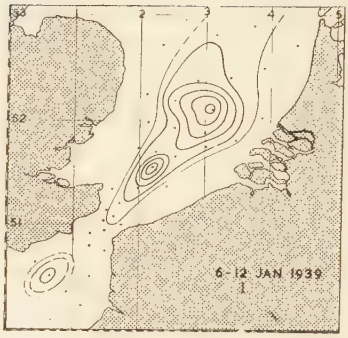

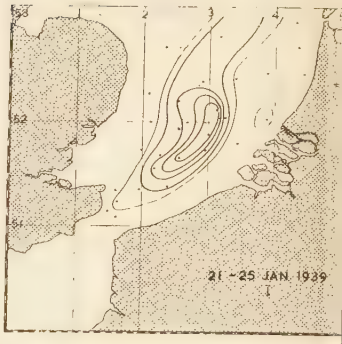

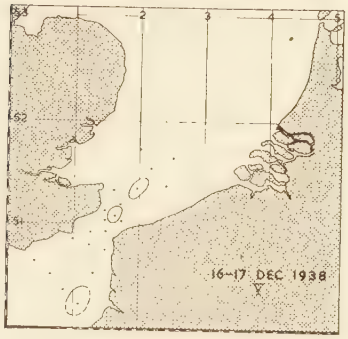

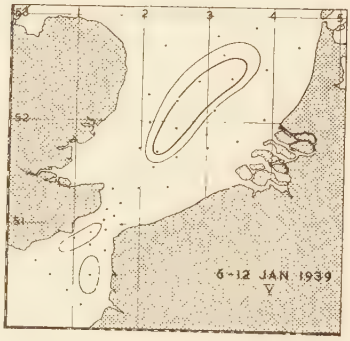

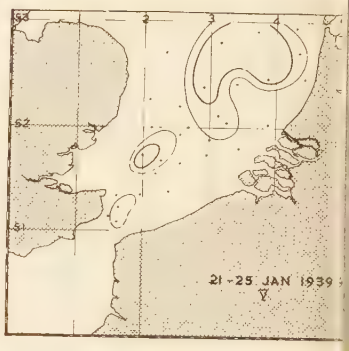

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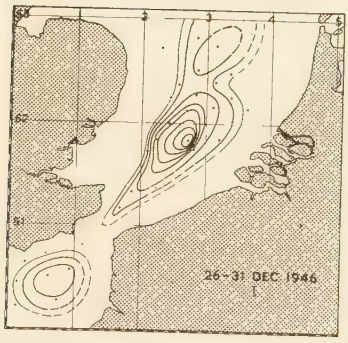
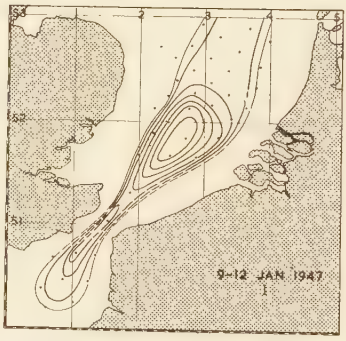
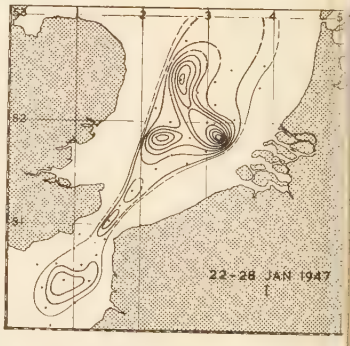
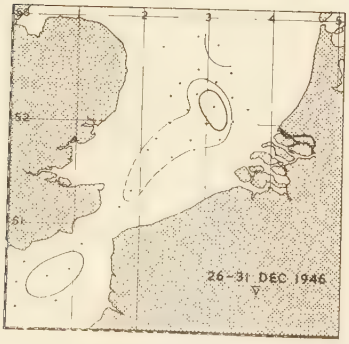
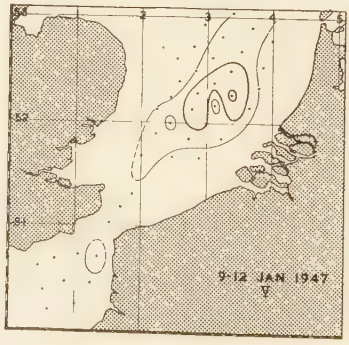
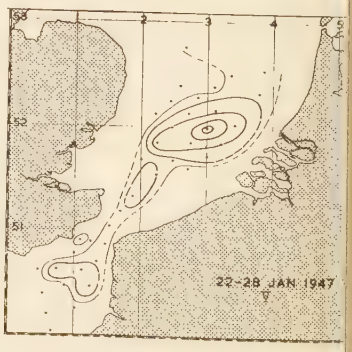




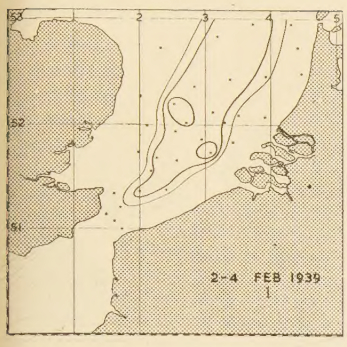


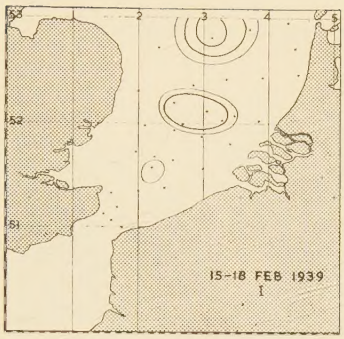


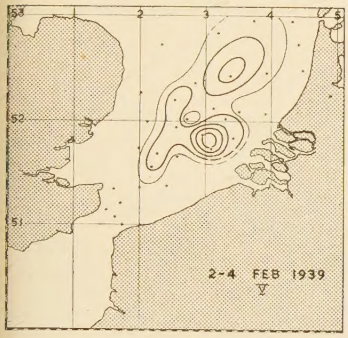


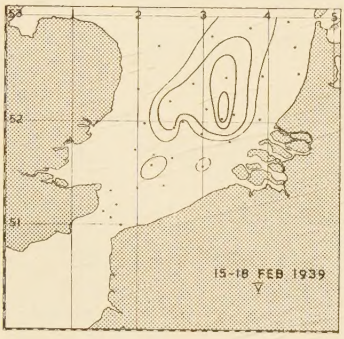


1938-1939

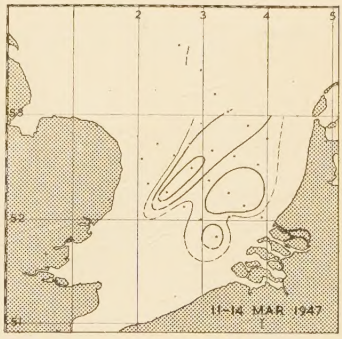


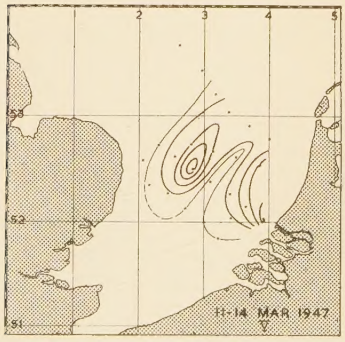






1946-1947





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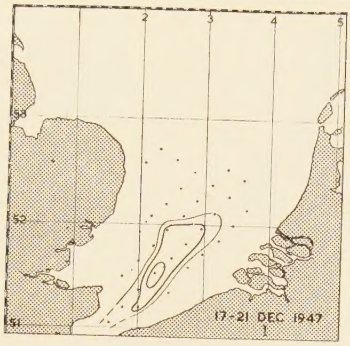

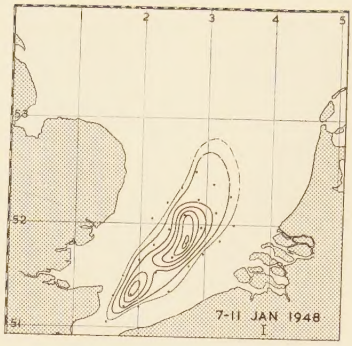

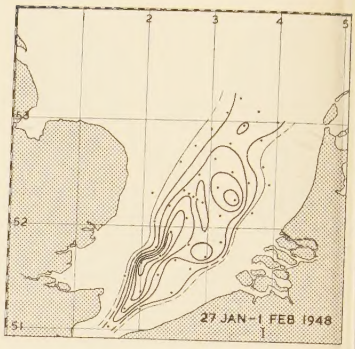

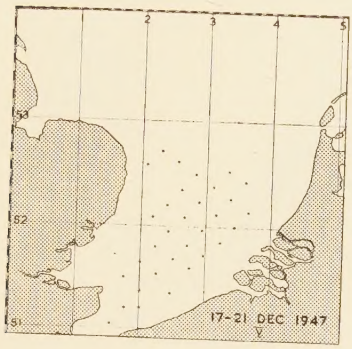

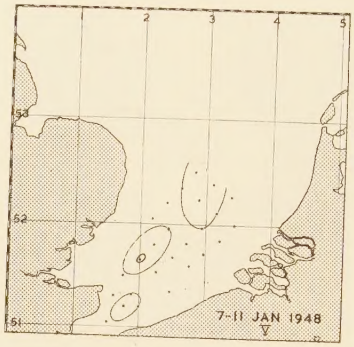

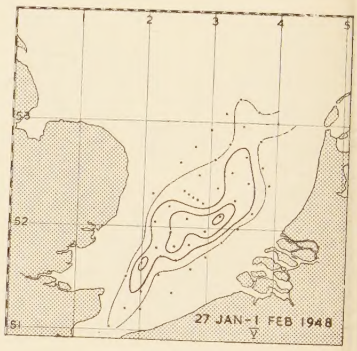

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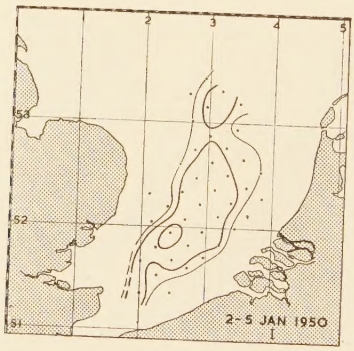

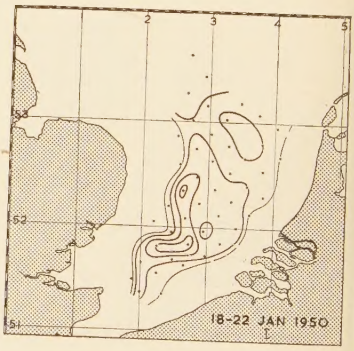

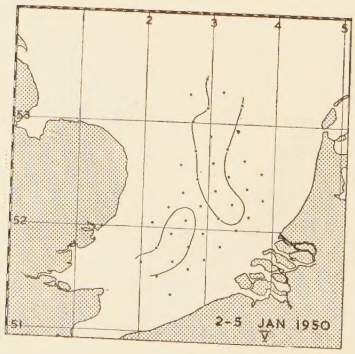

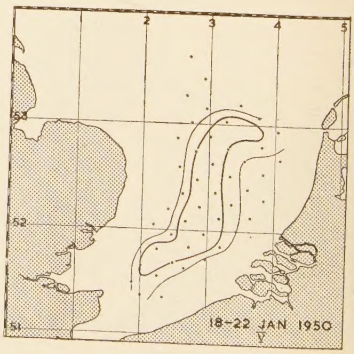

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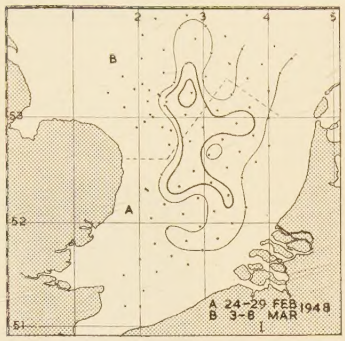
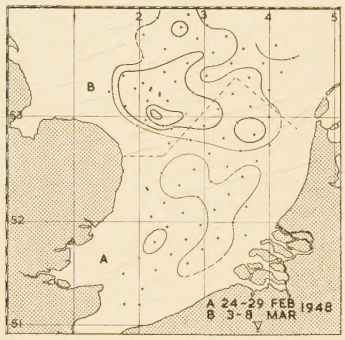
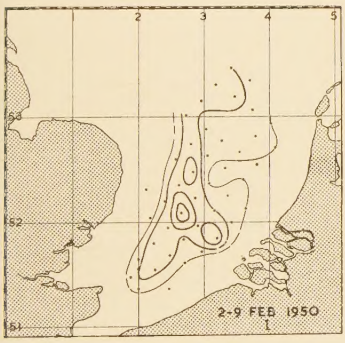
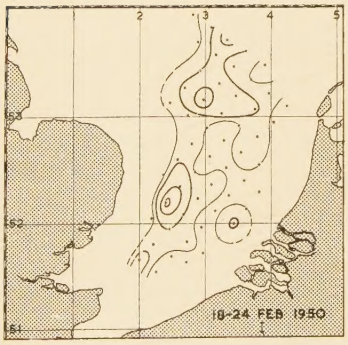
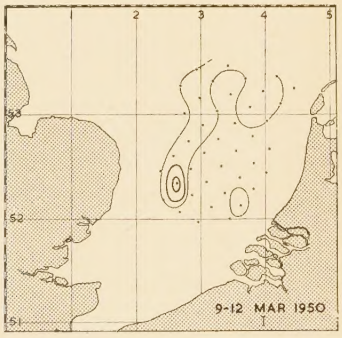


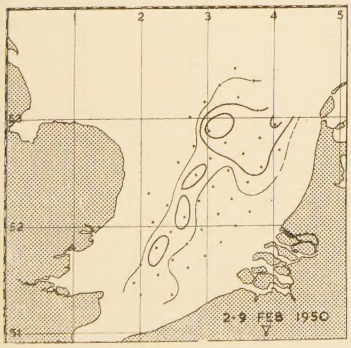


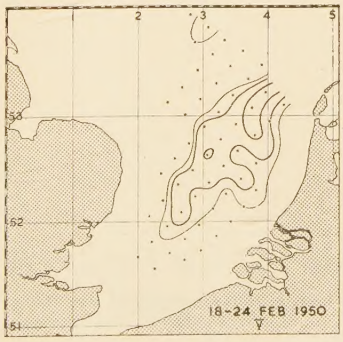
1949-1950

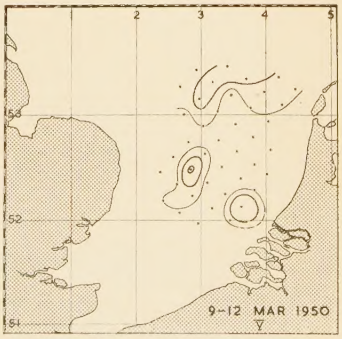












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